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ABSTRACT

LogoWriter provides the means through which students of varying backgrounds and abilities can experience different types of learning. It involves using problem solving, graphing, critical thinking, and other creative strategies. The lessons provided in this book contain ideas that allow beginners to explore various areas of Logo while using LogoWriter. Most lessons begin with the concrete, body-centered geometry and move to the abstract. Each lesson includes a variety of activities. The lessons can be conducted in various settings. They are intended as an introduction to LogoWriter and are designed for students with little or no experience in using the program. The book is divided into four parts: (1) Part 1 provides an overview, including an explanation of the hardware, software, and learning environment; (2) Part 2 is the graphics section, containing 14 lessons that explain the graphics of LogoWriter; (3) Part 3 describes art ideas and related activities; and (4) Part 4 contains information on resources which support LogoWriter. (TMK)

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About the Authors

Peggy Bergmann has been teaching in St. Albert, Canada, for 17 years. Peggy's interest in computers and their application to education has led to her involvement in designing and implementing two school-based computer labs, coordinating computer instruction in the elementary grades, and helping to establish a district Elementary Computing Plan.

For the past 17 years, **Marlene Keanie** has held a variety of teaching positions in British Columbia and Alberta, Canada. As an instructor of the gifted, Marlene is interested in using the computer in problem-solving situations.

Marlene and Peggy both have a bachelor's degree in elementary education. They recently completed a graduate-level computer course from the University of Oregon, Eugene. As a result of that course, they authored this book as one in a series of teacher manuals for beginning instruction in *LogoWriter*.

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Turtle Power:
Beginning Graphics
With
LogoWriter

By
Peggy Bergmann and Marlene Keanie

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From the Authors

This book is intended as a guide to any beginning learners in *LogoWriter*. It is appropriate for students as early as Grade 1. Older students with no previous experience with *LogoWriter* can use the basics in this book to help them get started. They will, however, be able to move through the lessons at a quicker pace, and go on to more advanced projects. Many of the worksheets and games provided are more suitable for younger learners, but could be adapted for older students.

We have used these lessons with elementary students of all ages. The games and disk activities have been as enthusiastically accepted by Grade 6 students at the beginning stages of learning *LogoWriter*, as they have been by Grade 1 students.

We wish to extend our special thanks and acknowledgment to Robert Hogg, Donna Oakes, and the St. Albert Protestant Board of Education for their help and support during the writing of this book.

Table of Contents

Part 1. Overview

Introduction 1
Why *LogoWriter*? 3
Creating the Environment 3
Hardware 5
Software 7
Scrapbook Disk 7
Before You Begin 8
Tips to Help You Stay Sane 9
Who Were the Real Scientists? 10

Part 2. Graphics

Introduction 15
Lesson 1. Getting Ready 17
Lesson 2. FORWARD and BACK 19
Lesson 3. FORWARD and BACK Using Large Numbers and Wrapping 25
Lesson 4. Magic RIGHT 27
Lesson 5. Magic LEFT and RIGHT 33
Lesson 6. Squares and Rectangles 49
Lesson 7. REPEAT 61
Lesson 8. PENUP, PENDOWN, and NAMEPAGE 69

Lesson 9. Other Turns 73
Lesson 10. Circles 85
Lesson 11. Triangles 97
Lesson 12. Color 113
Lesson 13. Combining Skills 117
Lesson 14. Shapes 119

Part 3. Art Ideas and Related Activities

Make Your Own Computer 129
Disk Name Tags 129
Turtle Rubbings 133
Egg Carton Turtle 133
Turn Turtle 134
Play Dough Turtles 135
Walnut Turtles 136
Paper Strip Turtles 136
Transparent Turtle Mobile 137
Paper Plate Turtles 137
Turtle Cookies 137
Tangy Turtle Punch 138
Lemon-Lime Punch 139
Individual Turtle Pizzas 139

Part 4. Resources

The Disk 141
A Few Tips 142
Turtle Commands 145
Creating a Logo Environment 147

Part I.

Overview

Introduction

Imagine a classroom where everyone participates regardless of his or her background and ability. Students busy themselves with exploring several possible solutions to problems. The process may vary, and there are no right or wrong ways to arrive at a solution. This is the basic philosophy of Logo.

Here is a story you can share with your students to get started:

> Once, in a small village, lived a group of very intelligent creatures known as the Brainy Bunch. Some say they were distant relatives of another famous foursome, the Ninja Turtles, but this information cannot be verified. The physical resemblance may have been similar, but then most turtles do look somewhat the same. However, the Brainy Bunch creatures were better known for their intelligence than their looks. Science and mathematics were their strengths, and they took great delight in working through problems in their labs.
>
> Franklin was their leader. He manned the headquarters where all of the problems were received. It was his job to assign the turtles to the tasks of working through the problems to a solution. He was a wise leader and knew that members of his

turtle team worked best when they were allowed to explore ideas on their own. From time to time the turtles would be seen consulting one another sharing their discoveries. Franklin was always close at hand. He was there to listen to their questions and assist them with suggestions if they were needed.

Einstein and Edison were the senior members of this team. Einstein worked to visualize the possible solutions to problems before he actually tackled them. Edison, on the other hand, excelled in pulling ideas apart or breaking them into smaller units so that each one could be examined separately before the big ideas were tackled.

Galileo's strength was in the ability to manipulate information and materials. The microscope and computer were his main tools.

A younger member of the group was Curie. Rules and procedures were important to her. Perhaps that is the reason she was so organized in all of her procedures.

The newest member of the team was Newton, Galileo's brother. He had just begun working with the group so he was not as confident about his abilities. However, with the help of the others and the encouragement of Franklin, he was learning to work through even the most challenging tasks.

Some people may think that working in the lab and applying scientific rules and principles in dealing with problems is not interesting work. Not so! The lab is often where the most important work begins. The Brainy Bunch knows that their activities are only a beginning and will lead to other interesting and challenging projects. Maybe that's why our Brainy Bunch is always busy with fun and exciting work.

> Why not join the Brainy Bunch as they work through the lessons set out in this book? Help them solve the problems.

Hopefully your class will have all of the Brainy Bunch types and more mentioned in the story above. We hope you will remember that each student views problems in a different way and will attack each problem differently. Remember, there is no one correct way to solve the problems, so allow students to explore freely but, like Franklin, please be ready to guide your students along. And most importantly—have fun!

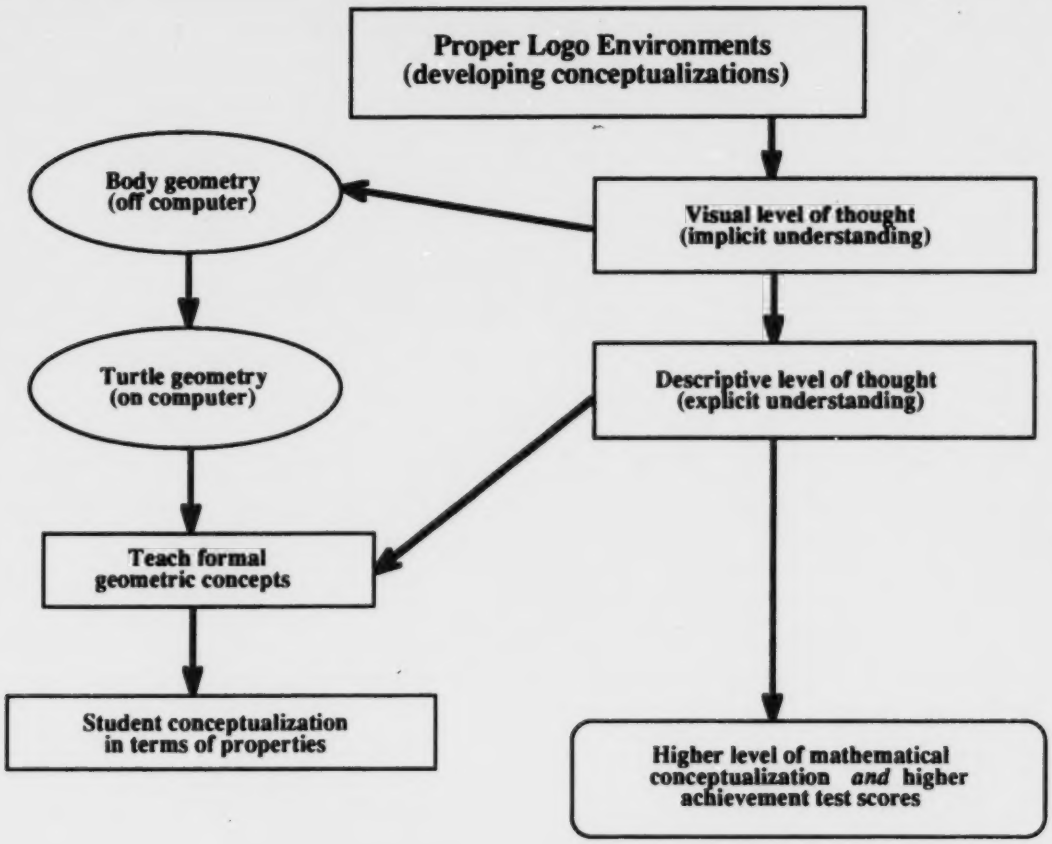
Why *LogoWriter*?

LogoWriter provides the means through which students of varying backgrounds and abilities can experience different types of learning. It involves using problem solving, graphing, critical thinking, and other creative strategies. More specific skills are indicated in the chart "Connecting Early Learning to the Curriculum" at the end of Part 1.

Creating the Environment

The lessons provided in this book contain ideas that allow beginners to explore various areas of Logo while using *LogoWriter*. Most lessons begin with the concrete, body-centered geometry and move to the abstract. Each lesson includes a variety of activities—it is not necessary to do every one. Teachers also may include their own additional activities.

The following diagram shows the Proper Logo Environments, following Logo's basic philosophy of moving from the concrete to the abstract.



The key is *engagement* of students *with* concepts through concrete experiences.

It is important that teachers serve as guides throughout the lessons. After a problem is posed, students should feel free to talk about their learning. Therefore, it is necessary to establish a safe atmosphere that allows students to take risks without being judged.

These lessons can be conducted in various settings. If only one computer is available to a class, one group of students can receive instructions and then teach other students. Or after one group has completed its lessons, another group can be taught.

If each student has a computer, the teacher can instruct the whole class at once.

There are other possibilities, and teachers are free to experiment with methods they feel best suit their teaching style and their students' learning styles.

Students should have set periods to work on their activities. Ideally, these work sessions should occur daily. While working through projects, students should be encouraged to discuss their discoveries with others. This allows for exploration and is the best way for students to learn *LogoWriter*.

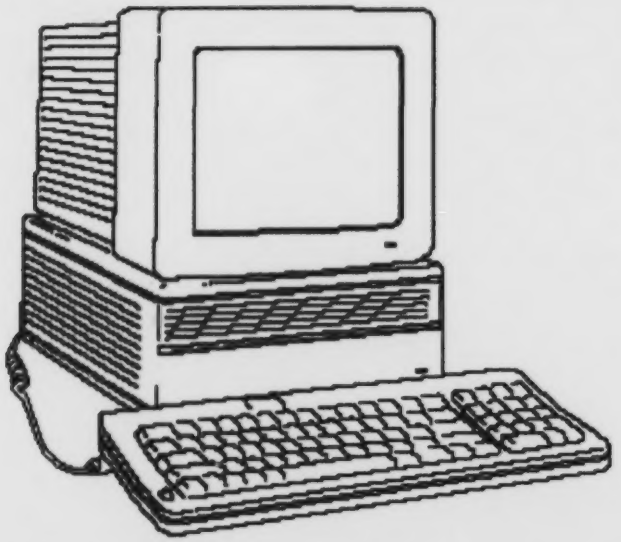
An area of the room can be designated as the computer center if only one computer is available. A bulletin board can be used to post procedures. If students keep journals about their work, these can be kept at the computer center to share. Suggestions for setting up a *LogoWriter* classroom can be found in Riordon's article "Creating a Logo Environment," which is reprinted in Part 4 at the end of this book.

The lessons are intended as an introduction to *LogoWriter* and are designed for students with little or no experience in using *LogoWriter*. Students will move through the lessons at different rates because they will have varying abilities. There is much more *LogoWriter* material that can be presented, and teachers are encouraged to move on as their students' ability and confidence improves. However, it is important not to overwhelm students. Instead they should experience the joy of learning as they discover for themselves the answers to *LogoWriter* problems.

Hardware

Many excellent sources provide detailed lessons to familiarize students and teachers with the hardware needed to run *LogoWriter*. Only the briefest description is included here. We do feel, however, that it is important that children become familiar with the proper terminology when using the computer.

Although computer systems vary somewhat according to brand name and capabilities, each has the basic components described here.



The monitor is your screen. It may be monochromatic—that is, it displays what is on the screen only in black and white or perhaps green and white or amber and white. Several projects in this book are designed for a color monitor. If you do not have a color monitor, you will need to skip these projects.

The keyboard looks like a typewriter keyboard and is used for entering information. Information goes from the keyboard into the central processing unit (CPU). This may or may not be attached to the keyboard. It is the "brain" of the computer, where all the information is received and processed.

Attached to the CPU is the disk drive. The disk drive may be part of the "box" containing the CPU, or it may be a separate, rectangular-shaped box. The disk drive has a skinny opening on one side into which you put your disk.

Some computer systems will be hooked up to a printer, allowing you to print what you see on the monitor. A printer is not necessary, but students get quite excited when they see their work printed.

You may wish to have your students make their own computers. See Part 3 of this book under Art Ideas for suggestions.

Software

This book is designed to be used with the Primary version of *LogoWriter*. *LogoWriter* is a version of the Logo programming language produced by Logo Computer Systems, Inc. (LCSI). *LogoWriter* includes all of the traditional Logo primitives but is based on the model of a Scrapbook. *LogoWriter* files are called *pages*. The directory or catalog of files is called the Contents Page. *LogoWriter* is available for all common brands of school computers: Apple II's and GS's, MS-DOS machines, and Macintoshes. A less sophisticated version of *LogoWriter* is available for Commodore 64 machines.

Scrapbook Disk

If you wish to have students save their work at any time, they will need a files disk, called a Scrapbook disk in *LogoWriter*.

This book includes a Scrapbook disk for your version of *LogoWriter*. (Scrapbook disks are available for Apple, IBM, and Macintosh versions of *LogoWriter*.) On this disk are the following programs referred to in this book.

BASEBALL

BIRTHDAY

CIRCLES

CITY

CROSS

EDISON'S.EXCURSIONS

EINSTEIN

GARFIELD

NEWTON

PARTY.PATH

RECTANGLES

STAIRS

TRIANGLES

TRY.BORDER

TRY.SQUARES

TRY.STAMPING

WRAP.IT.UP

You should make a copy of the Scrapbook disk that comes with this book. Store the master in a safe place. Then make as many copies of this disk as you need for your students.

A related classroom activity, making disk nametags, is listed under Art Ideas in Part 3 of this book.

Note: See your LogoWriter *manual for instructions on creating your own Scrapbook disks for your version of Logo.*

Before You Begin

You need to understand the following before you begin to work through the lessons in this book. Share this information with your students as it is needed.

1. The flashing square or line on the screen is called the *cursor*. It tells you that the computer is waiting for instructions.
2. The *Delete* key is found on the top row and right side of the Apple keyboard. It is used to erase typing errors. To erase, the cursor must be placed to the right of the error. Then by pressing the Delete key once, one space or letter to the left is erased. The names of some keys may vary slightly depending on which computer format you use.
3. Any time you want the computer to carry out an instruction you have typed, you must press the *Return* key to indicate that you have finished. Once you have pressed it, the computer will respond to your instructions.

4. You need to choose a NEWPAGE from the Contents Page every time you want to begin a new project.
5. You must name a page before you try saving any work. We have included this in a lesson part way through this book. You can use this lesson at any time you wish.
6. You need a Scrapbook disk to save *LogoWriter* pages. Refer to your *LogoWriter* manual to prepare such a disk.

Tips to Help You Stay Sane

1. Always make sure your tasks, directions, and task cards/sheets are *clear* and *simple*. Go through the steps yourself to be sure nothing is left out.
2. Be certain every student internalizes the rules for computer care and disk handling.
3. Plan to pair students at a computer. This gives everyone an opportunity to use the computer in a shorter span of time and enables the less able to work with the more capable. Two minds working on a problem can be beneficial, and it fosters communication skill development.
4. Keep initial tasks limited to 15 to 20 minutes until proficiency increases. Generally, students cannot afford much more time away from other class work at the beginning stages of learning *LogoWriter*.
5. Always station your classroom computer where it won't be distracting to others and so the screen is visible to you.
6. Use a data projection unit with an overhead projector and computer to facilitate initial instruction and sharing of student work.
7. Schedule students to use the computer when they are involved in independent practice, not when you are providing direct group instruction on a concept.

8. Take special care with scheduling of computer time to account for individual differences in levels of ability and speed of progress.
9. Train a core of capable students to be a SWAT team to act as mentors/helpers in the use of certain programs, task cards, and so forth. Train some adult volunteers as well.
10. Use the "Ask three before you ask me" rule once you begin to use the computer extensively. This will prevent the continuous flow of questions to you when they can often be answered by others. Establish firm class expectations to guide this process. Develop a help signal when a student needs your assistance. For example, put a sign on top of the computer with "working" written on one side and "help" written on the other. Or use two differently colored plastic cups that can be inverted when help is needed.
11. Develop a system for keeping track of student pages (files) and disks.
12. Teach a trustworthy parent how to print files. This may otherwise end up taking up a lot of your time!
13. If an activity isn't working well, don't feel obligated to continue it. Turn off the computer for a day or two and regroup.
14. Expect at least a couple of "disasters" to occur as you begin to use computers with your class. Keep smiling and don't lose heart. The results of incorporating computers into your teaching practices will be well worth it!

Who Were the Real Scientists?

Here is a brief synopsis of the scientists mentioned in the scenario at the beginning of the Overview.

Galileo (1564-1642)

Galileo is known as the founder of modern experimental science. He was interested in physics and astronomy and

was the first to use the telescope to discover new ideas about astronomy.

Galileo also discovered the law of the pendulum and the law of falling bodies. Among his inventions are the hydrostatic balance and the sector used by drafters. He also improved the telescope through his work in astronomy.

Sir Isaac Newton (1642-1727)

Newton, a scientist, philosopher, astronomer, and mathematician, is probably best known for his theory of gravitation.

He also invented a new kind of mathematics known as calculus. Another of his important discoveries is optical prismatics and the secrets of light and color.

Marie Curie (1867-1934)

Marie Curie was a French physicist best known for her work in radioactivity. She worked with her husband to study how radiation was given off by radioactive substances. Uranium ore was used in their experiments to produce highly radioactive chemicals.

For this work, she received the Nobel Prize in physics. Later she received a second Nobel Prize, this time in chemistry, for her work in isolating radium to study its chemical properties.

Albert Einstein (1879-1955)

Albert Einstein is considered to be one of the great scientists of modern times. His special gifts were physics and mathematics. Using these, he discovered answers to many problems. His mathematical formulas produced the theories of atomic energy and revealed knowledge of the power within the atom.

His Theory of Relativity is studied by students of science around the world to this day. This theory and his other works have become part of the fund of knowledge for formulating future theories and works of science.

Thomas Alva Edison (1847-1931)

Even as a young boy Edison experimented with various ideas in science. This began at first as a hobby but soon became his life's work. During his lifetime he made many contributions to our world and is regarded as the greatest inventor in history.

It was Edison who coined the phrase that genius is "one percent inspiration and ninety-nine percent perspiration." He demonstrated this principle by working nonstop for days on end except for short naps.

Among his contributions are an electrographic vote-recorder; the carbon transmitter, which clarified speech over the telephone; the phonograph; the microphone; the motion-picture projector; and, of course, the light bulb.

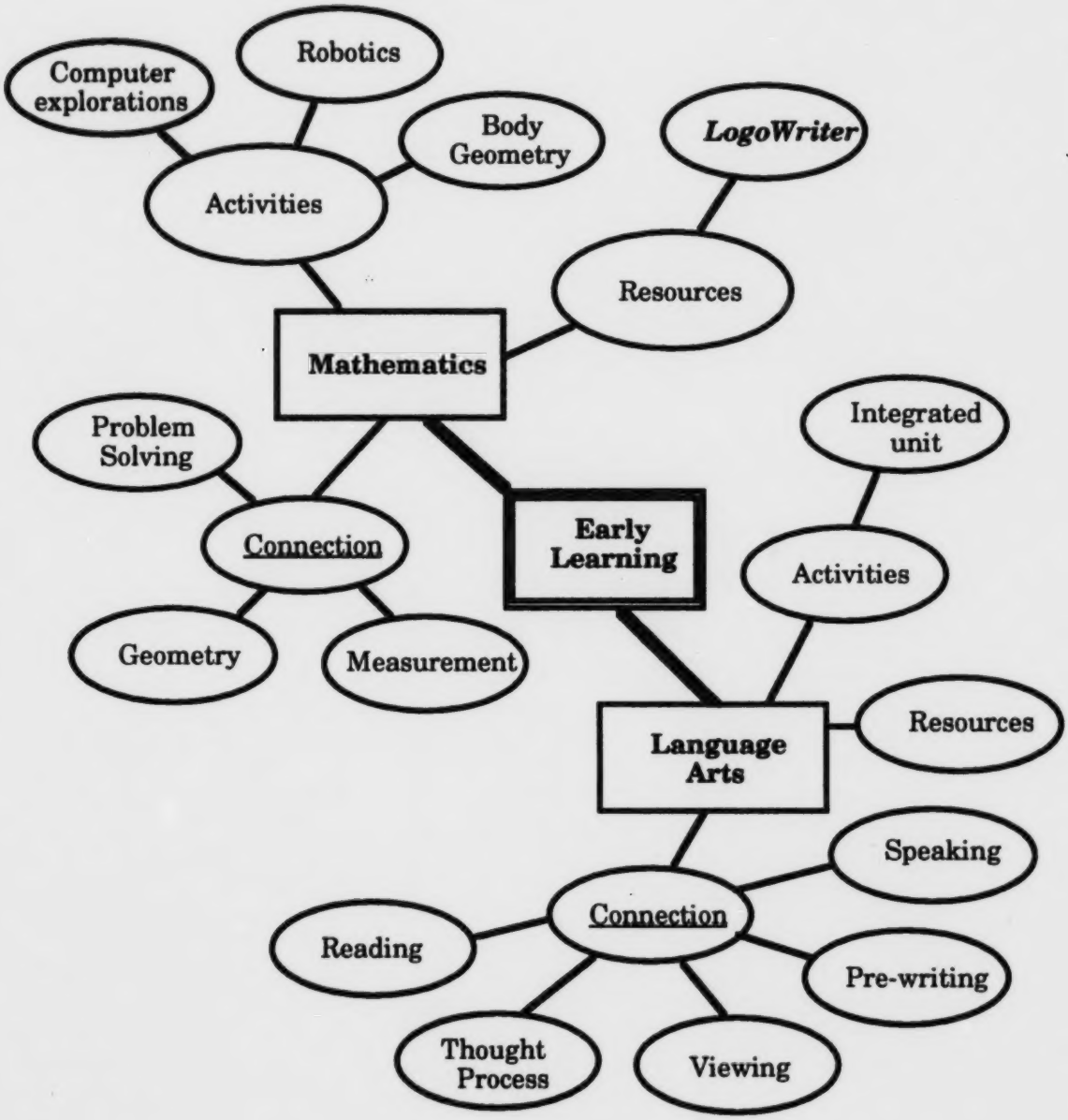
Benjamin Franklin (1706-1790)

Benjamin Franklin accomplished many things during his lifetime. He was interested in a variety of things, from politics to science.

Franklin was a leader in his time in the study of electricity, proving, among many things, that lightning is electricity. He invented the lightning rod as a means of protecting buildings against lightning.

Some of his other contributions include research on the Gulf Stream, diseases, and soils, and the invention of the Franklin stove and bifocal eyeglasses. He never accepted payment for his discoveries, choosing instead to donate his services and gifts to the betterment of humanity.

Connecting Early Learning to the Curriculum



Part 2.

Graphics

Introduction

In this section, students will learn to use the turtle to draw on the computer screen.

The student is taken through a progression of activities involving body geometry (concrete), seat work (pictorial), computer exploration (abstract/symbolic), and, finally, enrichment activities.

The large number of lessons provided in this book is not intended to overwhelm teachers or students but rather to provide guidelines and suggestions. The main objective is to have fun while exploring and discovering with *LogoWriter*.

Many of the lessons are introduced first through games in which students play the role of the turtle. Playing turtle is a most useful and important activity as it encourages the student to identify with and personalize the experiences of the turtle. In a group situation, everyone must agree on the terminology to be used in commanding the turtle. Because the turtle must play the game correctly in following the exact commands given, it is suggested that the teacher play the turtle role the first few times. In this way, the turtle's behavior can be modeled correctly for the students.

Each lesson includes sections called "Teacher Talk" and "Student Activities." Student Activities include Disk activities (to be carried out using the Scrapbook disk provided), Games (instructions are provided immediately following the lesson write-up), Worksheets, Task Cards, and

Transparencies (these are given on reproducible pages at the end of each lesson), and Enrichment activities.

Remember, the lessons and activities in this book are intended for use with the *LogoWriter* computer program. The disk that accompanies this book is only a "data" disk and must be used in conjunction with a purchased *LogoWriter* program. For information, you may call Logo Computer Systems, Inc. at 1-800-321-LOGO.

Lesson 1. Getting Ready

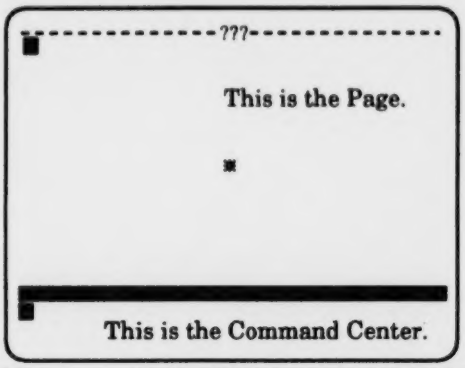
Goals

Students will be encouraged to:

1. Select a new page.
2. Recognize the drawing area and the command center.
3. Recognize the cursor as a symbol waiting for a typed instruction.

Implementation

Teacher Talk	Student Activities
1. Review the parts of the computer and correct handling of disks.	
2. Start the computer with *LogoWriter*.	
3. Press Return when you see the "splash screen" with the word *LogoWriter* on it.	
4. When the Contents Page appears, select NEWPAGE.	

5. Talk about the parts of the page.  	
6. Introduce the cursor as the symbol that the computer is waiting for instructions to be typed. Note: The computer will not allow you to return to the Contents page without naming this page. Students do not need this information at this point. When you have finished this lesson, type LEAVEPAGE, exit *LogoWriter,* and remove your disk.	

Notes

Lesson 2. FORWARD and BACK

Goals

Students will be encouraged to:

1. Manipulate the turtle with the FORWARD and BACK commands.
2. Recognize the abbreviated forms of FD for FORWARD and BK for BACK.
3. Understand that instructions are not carried out until the Return/Enter key is pressed.

Implementation

Teacher Talk	Student Activities
1. Play the game using the turtle commands FD and BK.	Games: *Edison Exclaims* and *Franklin's Frolic*
2. Take the students to the computer. Review the previous lesson on getting a new page. Draw their attention to the flashing cursor in the Command Center. Explain to the students that Logo is the language the turtle understands. Special words called *commands* tell the turtle what to do.	
3. Have students practice typing commands. Type FD (space) 40 then press Return/Enter. Watch the turtle move.	

4. Encourage students to try a variety of two-digit numbers with FD (space).	
5. Follow the same procedure with the command BK. Note: The turtle will not understand what to do if there is no space between the command and the number. Encourage your students to experiment with and without the space. If the message "I don't know how to..." appears in the Command Center, there is a typing error.	
6. To reinforce the concepts introduced, have students complete the *Turtle Target* worksheet. Be sure to do an example on the board first.	Worksheet: *Turtle Target*
7. As an extension of this lesson, encourage the students to play *Curie's Clothesline.*	Game: *Curie's Clothesline*

Game: *Edison Exclaims*

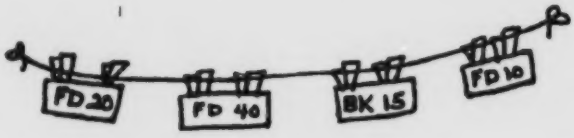
(Based on the children's game Mother May I.) Instead of using giant steps and baby steps, students are given commands such as FORWARD 10 or BACK 20. These steps should be heel to toe so that everyone has a clear understanding of what one step is.

Game: *Franklin's Frolic*

The teacher sets out a straight path of masking tape on the floor. One student playing turtle begins at the starting point, or HOME. Children take turns giving commands to the turtle to try to keep it on the path. Steps are again heel to toe. Children are encouraged to estimate the number of steps it will take to complete the trail before the turtle begins the journey. This game may be played several times with varying lengths of paths, or played backwards.

Game: *Curie's Clothesline*

String a clothesline of string across one corner of the classroom at a height that students can reach. Provide colored blank cards and clothes pins. Yellow cards are for FD commands and blue are for BK. Set up the game by preparing some of these cards with commands printed on them. Encourage students to choose a set of three or four cards, hang them on the clothesline, and then enter them using the computer. You will want to add other colors of cards for turns and other commands as students learn them in later lessons.



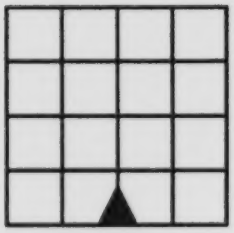
Notes

Turtle Target

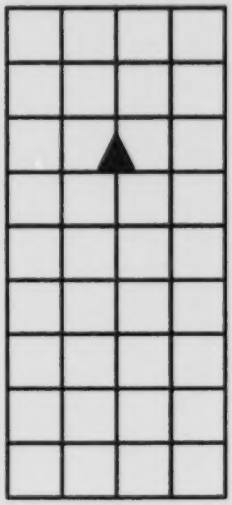
Each turtle has a new target. Draw him in the new spot.

Example: FD 2

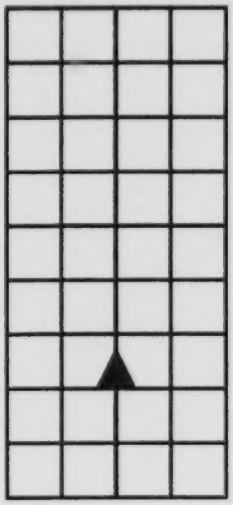
1. FD 3



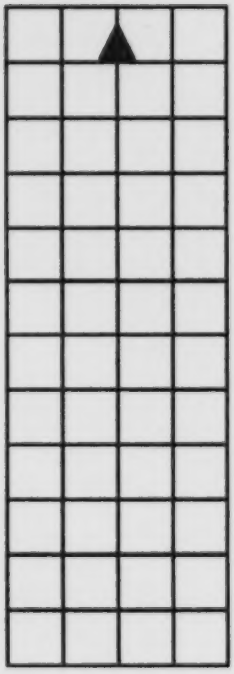
2. BK 4



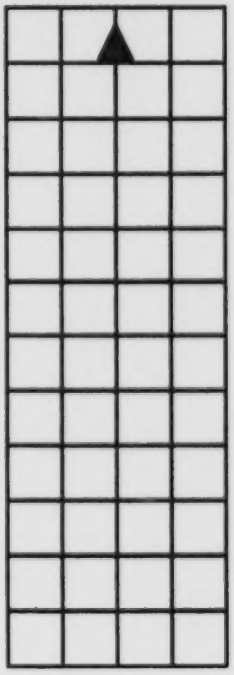
3. FD 5



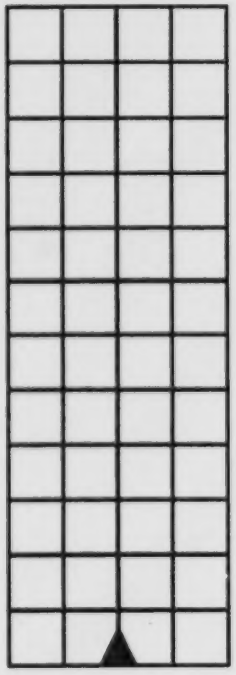
4. BK 8



5. BK 10



5. FD 9



Lesson 3. FORWARD and BACK Using Large Numbers and Wrapping

Goals

Students will be encouraged to:

1. Try large numbers with FORWARD and BACK commands.
2. Make observations to determine what happens to the turtle.
3. Understand that the abbreviation CG clears the screen and Return/Enter returns the turtle to its original starting position in the middle of the screen.

Implementation

Teacher Talk	Student Activities
1. Review the basic commands (FD BK).	
2. Encourage students to try big numbers with these commands.	
3. Instruct them to observe what happens to the turtle. Discuss these observations. Teach the term *wrapping*—when the turtle moves around the "back" of the screen. This concept can be demonstrated by passing an object from one hand to the other behind your back.	

4. Have students predict how many turtle steps are needed to take the turtle to the top or bottom of the screen before the turtle falls off the edge.	
5. Have students work at the computer to test their predictions.	
6. When students wish to clear their screens to start over again, instruct them to type the command CG. This command clears the screen of any graphics, and Return/Enter returns the turtle to its home or the starting position in the middle of the screen.	Activity: *Experiment with wrapping*

Notes

Lesson 4. Magic RIGHT

Goals

Students will be encouraged to:

1. Recognize the abbreviated form of RT for the RIGHT turn.
2. Experiment with "magic turns" (90°).

Implementation

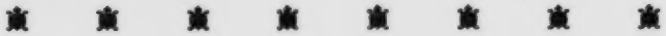
Teacher Talk	Student Activities
1. Have students type in RT 90 (Return/Enter) and watch the turtle turn. Explain that this is the Magic Turn.	
2. Encourage students to explore the classroom to find examples of Magic Turns.	
3. Work with the file *Wrap.It.Up.*	Disk: *Wrap.It.Up*
4. Have students return to the computer and try to draw a square. Explain that the corners of a square are all Magic Turns.	
5. Work with *Party Path.*	Disk: *Party Path*
6. Work with the worksheet *Turtle Town* and/or *Turtle Trek.*	Worksheets: *Turtle Town* and *Turtle Trek.*

Disk: *Wrap It Up!*

Imagine that Einstein is going out to a surprise birthday party for Newton. He needs to wrap his gift. Let's help him out. The gift is the same size as your screen. Wrap up your screen both ways: top to bottom and left to right. There, now he's ready for the party. Let's hope that they have fun!!! (See the example on the disk).

Disk: *Party Path*

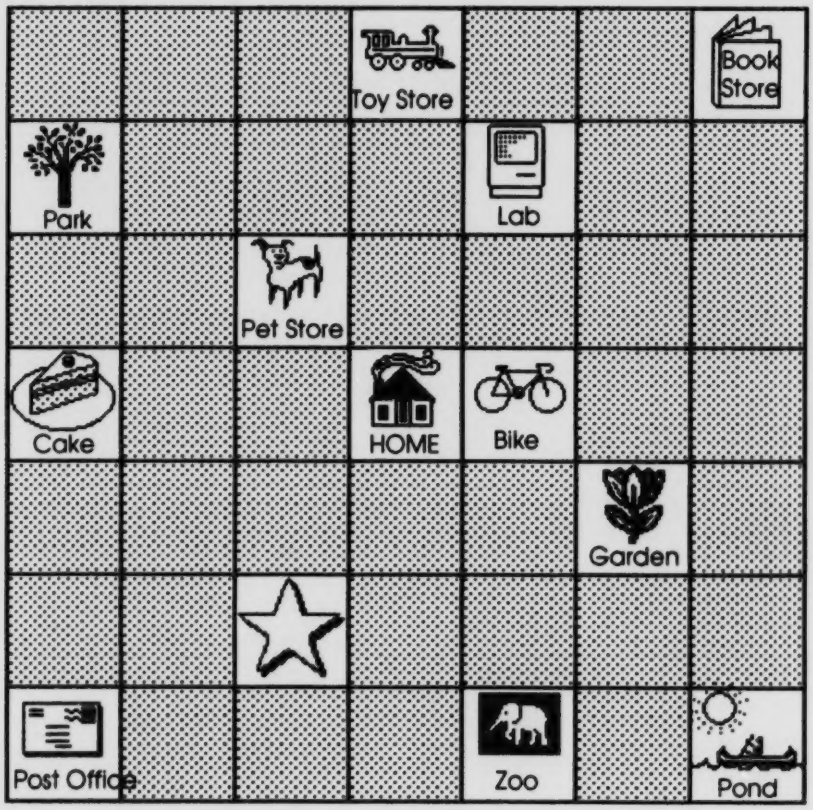
Using FD and RT commands, students will move the turtle through the maze.



Notes

Turtle Town

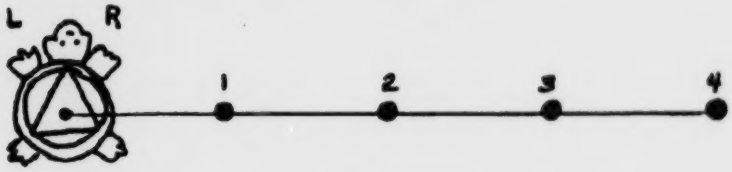
Go for a walk around Turtle Town. Start at Home.



FD 3	Where are you? _____
RT 90 FD 3	Where are you? _____
RT 90 FD 6	Where are you? _____
RT 90 FD 2	Where are you? _____
FD 4	Where are you? _____
RT 90 FD 3	Where are you? _____
FD 2	Where are you? _____
RT 90 FD 4	Where are you? _____
RT 90 FD 2	Where are you? _____
RT 90 FD 1	Where are you? _____

Turtle Trek

Newton is going to the lab, but he first needs to collect his equipment. He needs your help! What commands should he follow?

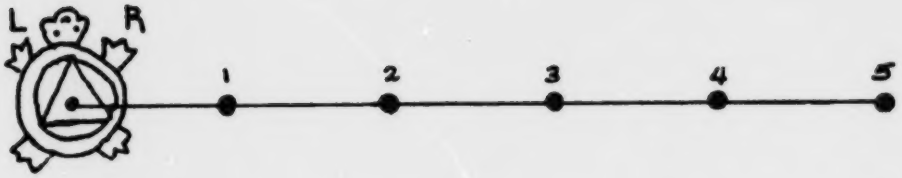


RT 90

FD 4

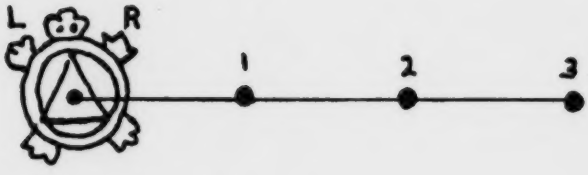
RT 90

___ ___



___ ___

FD ___



___ ___

___ ___

Lesson 5. Magic LEFT and RIGHT

Goals

Students will be encouraged to:

1. Manipulate the turtle with the left turn and right turn commands.
2. Recognize the abbreviated forms of LT for left turn and RT for right turn.

Implementation

Teacher Talk	Student Activities
1. Begin with body geometry. Discuss the right side and left side of the body. Follow up by playing *Curie Calls.*	Game: *Curie Calls*
2. Provide the students with a copy of *Turtle Turner* to reinforce RT and LT.	Worksheet: *Turtle Turner*
3. Encourage students to use the *Terrific Turns* to help complete the worksheet.	Worksheet: *Terrific Turns*
4. For more reinforcement, play *Turtle Tango.*	Game: *Turtle Tango*
5. Challenge students to draw a set of stairs across the screen from one corner to the other.	Disk: *Stairs*

6. Provide a copy of *Galileo's Grid* to each student. Students should draw a plan of the first letter of their first name. This kind of letter is called a *block* letter. Now they can go to the computer and draw it. (See the *Block Letters* sample in the worksheets near the end of this lesson.) Note: The first instruction needed will be an LT and then a BK command to start the turtle at the bottom of the page. (Students will still be in the bottom center of the screen. They can work from there until they learn to use pen up and pen down commands).	Worksheet: *Galileo's Grid*
7. Students may now be ready to play *Logo Letters.*	Game: *Logo Letters*
8. Enrichment: For students who would benefit from the extra challenge.	Transparencies: *Turtle Tunnels* and *Turtle Maze.*

Game: *Curie Calls*

(Based on the game Simon Says.) Add the word "right" or "left" to the activity instructions, e.g., "Curie calls put your right hand on your head"; "Curie calls touch your nose with your left finger"; "Curie calls hop on your left foot."

After students understand the concepts of right and left, include a review of FD and BK commands with movements.

Game: *Turtle Tango*

Put on some lively music and call out moves (as a square dancer would) FD 10, RT 90, BK 10, LT 90, and so forth in time to the music.

Disk: *Stairs*

A set of stairs appears on the screen from the bottom left to the top right corner. Students practice the concept covered by trying to reproduce the set of stairs on an empty screen.

Game: *Logo Letters*

Divide the class into teams or pairs. Choose one judge from the class. One student from each team must be spokesperson for that team. To begin, give each spokesperson a folded paper with a letter printed on it. When the teacher says "go," the spokesperson unfolds the paper and begins to give directions to the programmers at the computer. The object of this game is for the spokesperson to communicate directions to the programmer to draw the letter on the screen without revealing what the letter is. The first team to finish calls STOP and all drawing must stop while the judge compares the letter on the paper with the letter on the screen. If the two match, that team wins a point. If they do not match, the drawing resumes until another team calls STOP. As a language extension, you may give bonus points to team members who can supply words beginning with their Logo letter. You may wish to include a time limit for the various parts of this game.

Notes

Turtle Turner

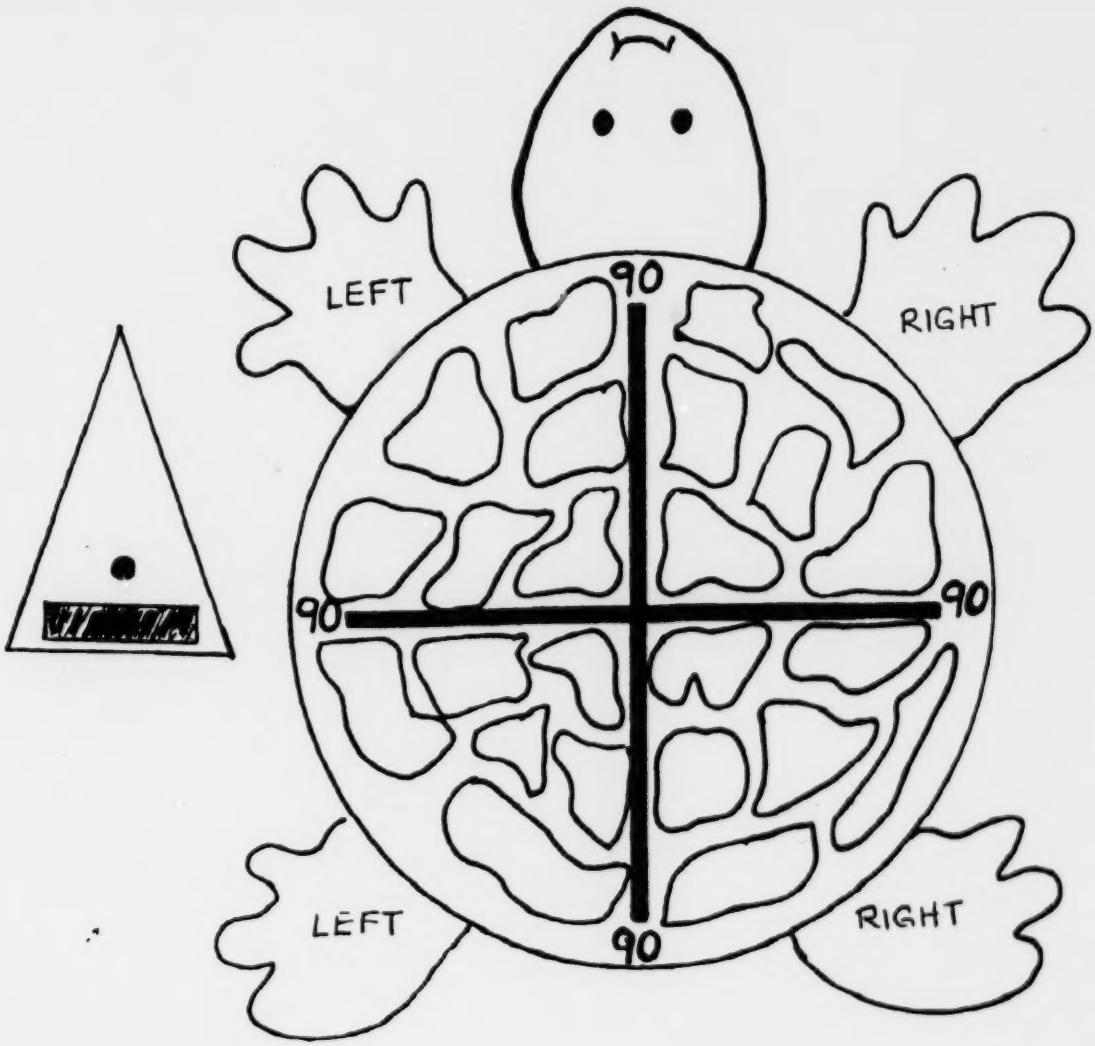
Color the big turtle shell GREEN.

Color the RIGHT legs BLUE.

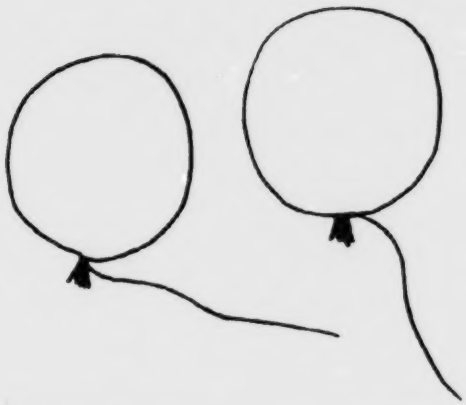
Color the LEFT legs RED.

Color the triangular turtle.

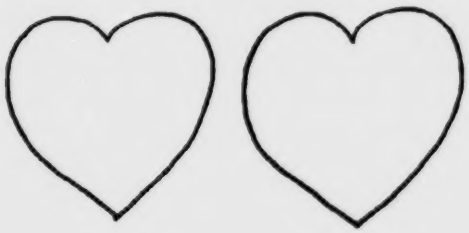
Cut out both turtles. Now, use a brass fastener to attach the dot on the triangular turtle to the big turtle at the place where the two lines cross.



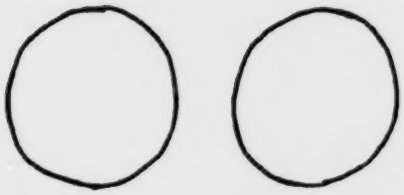
Terrific Turns



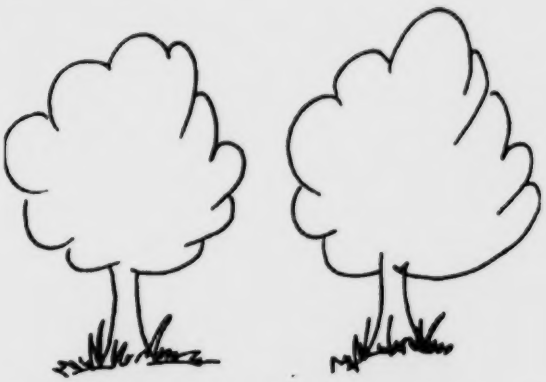
Color the balloon on the LEFT.



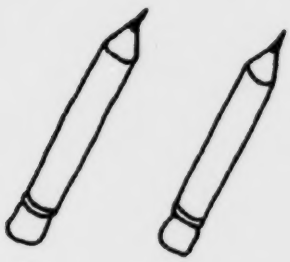
Draw lace around the heart on the RIGHT



Draw a happy face on the circle on the RIGHT.



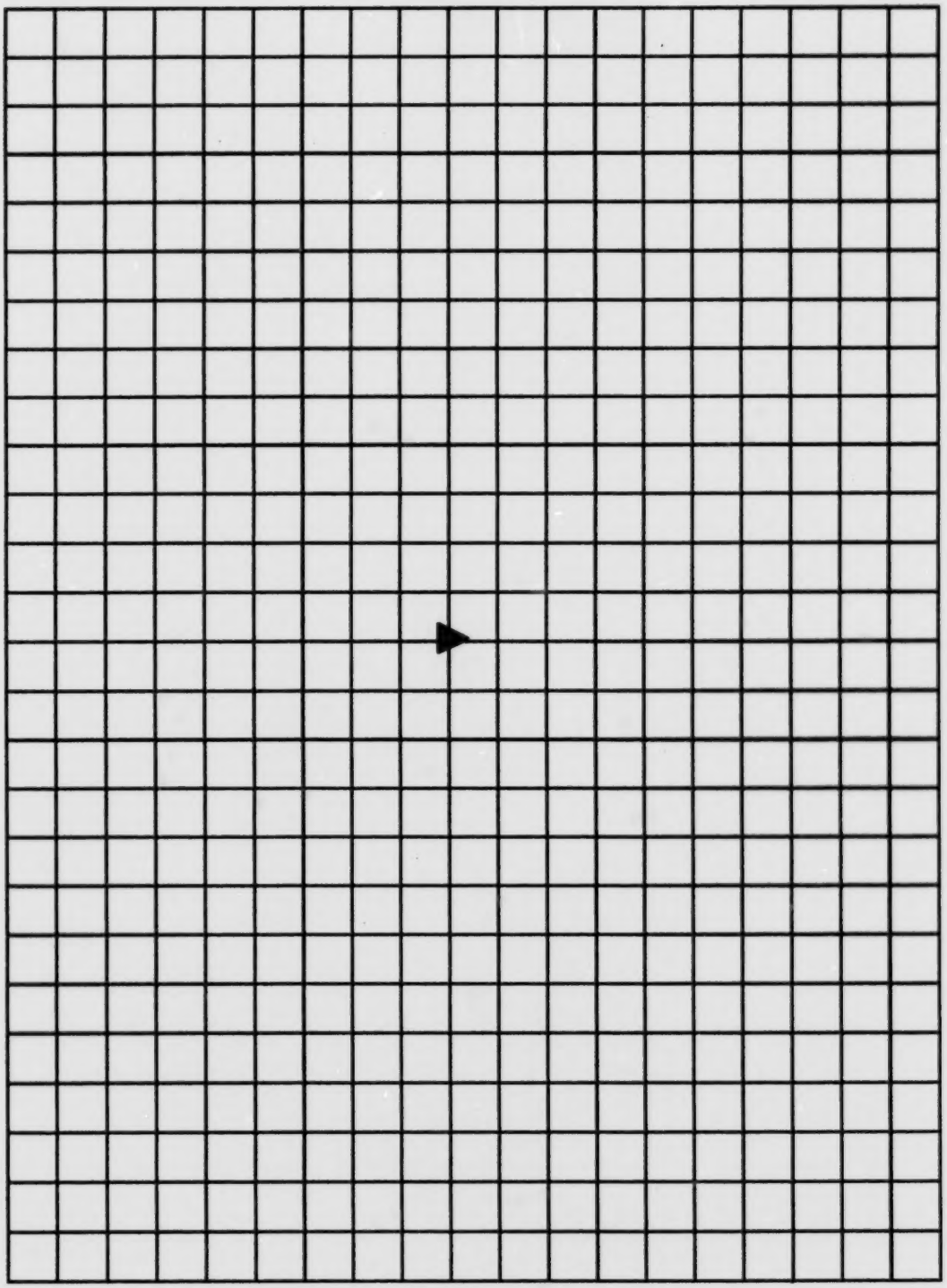
Draw apples on the tree on the LEFT.



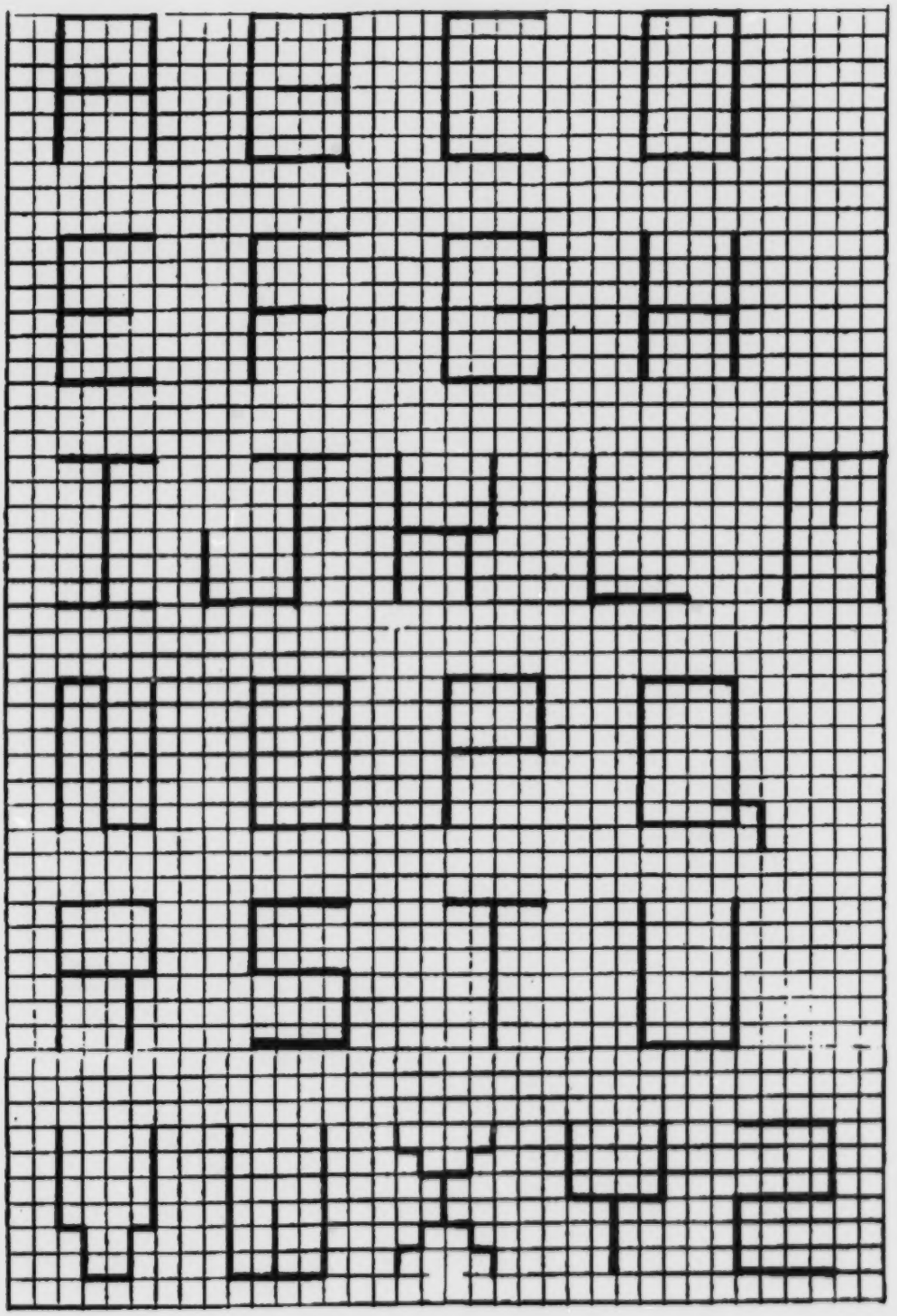
Color the pencil on the RIGHT.

Color the flower on the LEFT.

Galileo's Grid

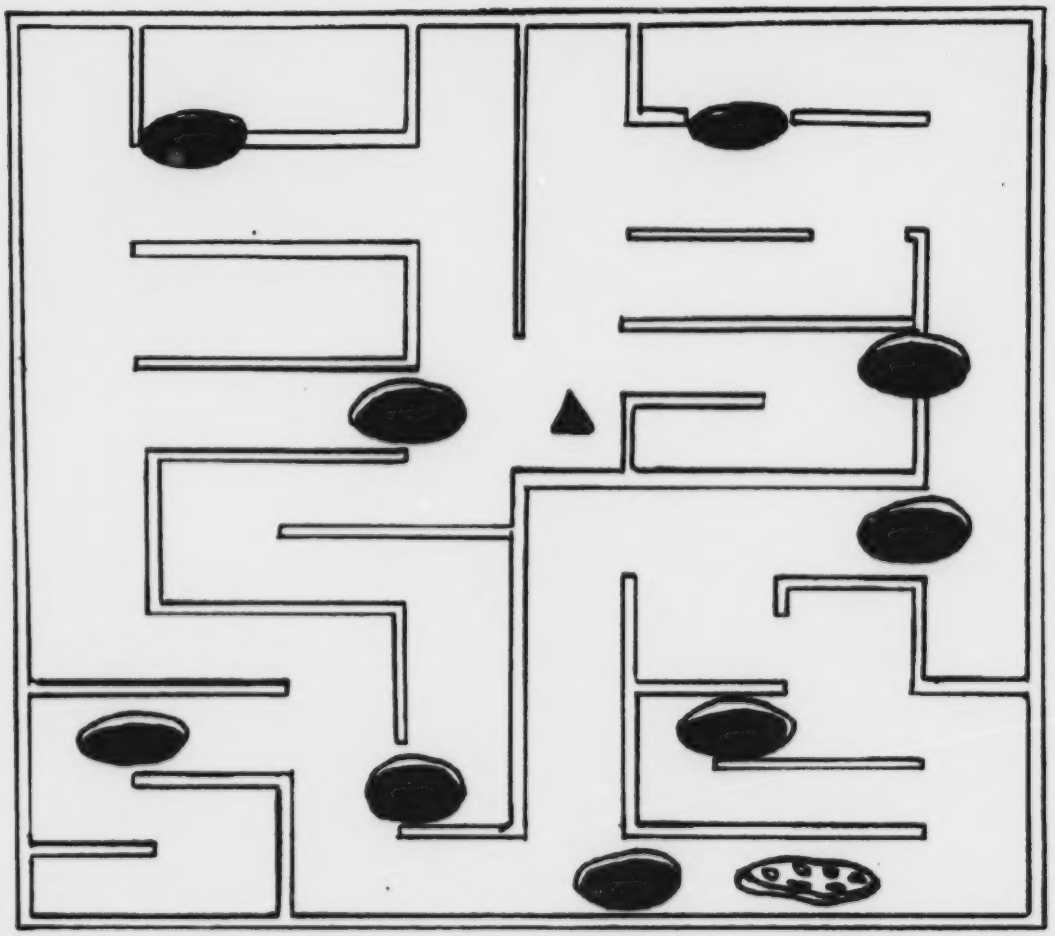


Block Letters

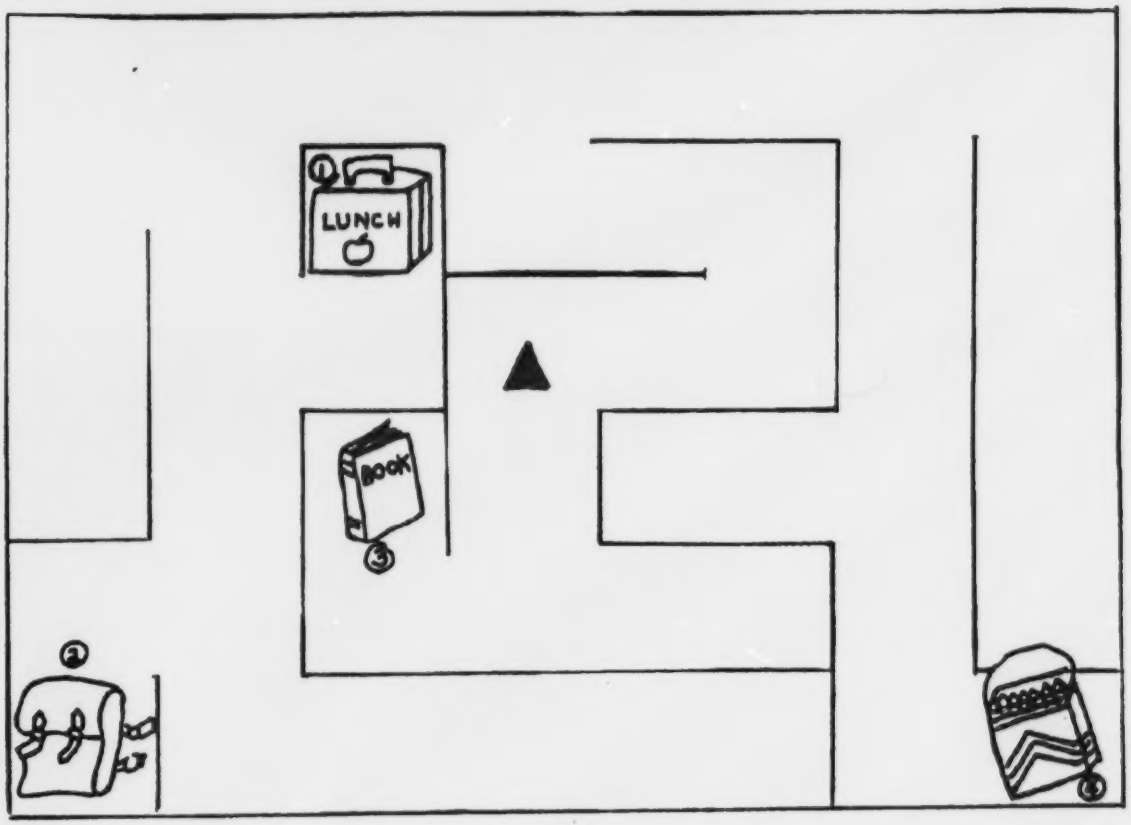


Turtle Tunnels

Help the turtle find the pizza. Be careful not to fall into the sewers!



Turtle Maze



Lesson 6. Squares and Rectangles

Goals

Students will be encouraged to:

1. Practice using the commands FD, BK, RT, and LT to draw a square.
2. Explore a variety of sizes of squares.

Implementation

Teacher Talk	Student Activities
1. Review Magic Turns.	
2. Ask the students how they would tell the turtle to draw a square. Draw a square on the chalkboard. Have the class count the number of sides and compare their lengths. Ask how many turns the turtle took. Ask what kind of turns these were. Call on one student to follow the trail of the turtle as the other students call the commands. Write these commands on the board as students call them out. (Students should understand that squares have four equal sides and four equal angles). Choose a student to walk out a square while you write the commands on the blackboard.	

3. If appropriate, provide the worksheet on searching for square shapes.	Worksheet: *Shape Search: Squares*
4. Instruct the students to draw the biggest square they can on the screen without wrapping. Have students write down the instructions they used. Include time for sharing their instructions and comparing their squares.	
5. Instruct the students to draw a square with sides of 100 turtle steps. When they have finished, ask them to draw a smaller square inside the first square.	Enrichment: Try drawing a third square inside the other two squares.
6. Provide enrichment activities where appropriate. Note: Students enjoy working with squares, so they should have several opportunities to experiment with them.	Enrichment–Disk: *Try.Squares* Fill your screen with as many squares as you can. Build a ladder or turtle tower using only squares.
7. Use the worksheet of squares to create a picture that students then try to transfer to their computer screen.	Worksheet: *Square Shapes*
8. Discuss the differences between a square and a rectangle. Try the worksheet *Logo Rectangles.*	Worksheet: *Logo Rectangles* Disk: *Rectangles*

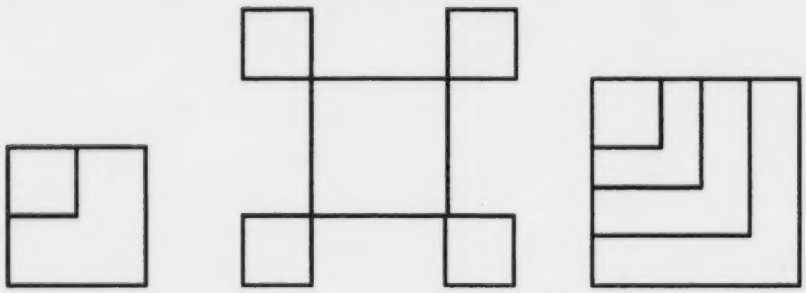
9. Enrichment: Copy Task Cards onto colored tag board and cut each sheet in half horizontally to separate the two tasks. Students attempt to draw the shapes on their computers.	Task Card: *Flags* Task Card: *Pinwheel*

Follow steps 4, 6, and 8 above to explore and discover rectangles.

Allow plenty of time for students to explore these new concepts.

Disk: *Try.Squares*

There are three exercises for students to choose from:

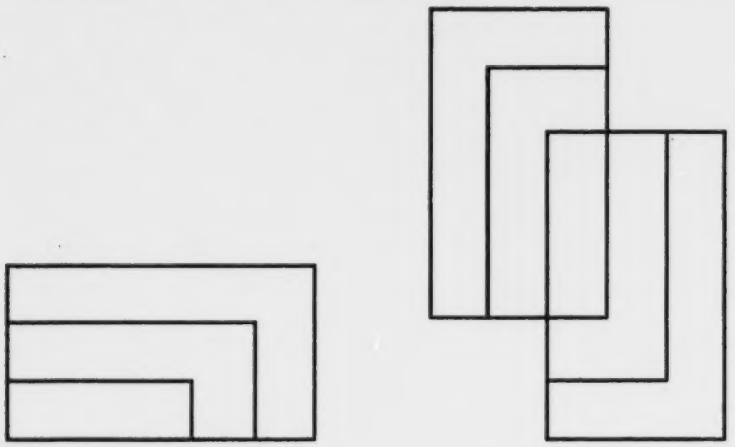


(A) (B) (C)

At the beginning of the program, students are shown the three shapes. They are instructed to choose A, B, or C and to try drawing one. If they make a mistake and wish to start over, they simply press the chosen letter again. Encourage them to write down the commands that work.

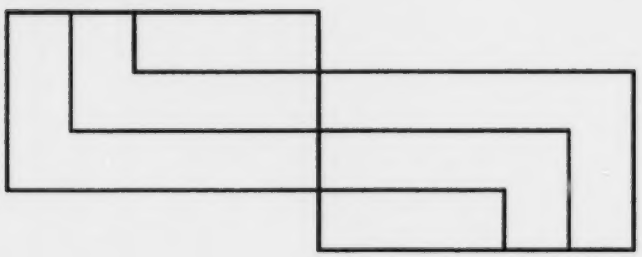
Disk: *Rectangles*

The challenge is set up in the same way as *Try.Squares*. The three drawing models look like this:



(A)

(B)



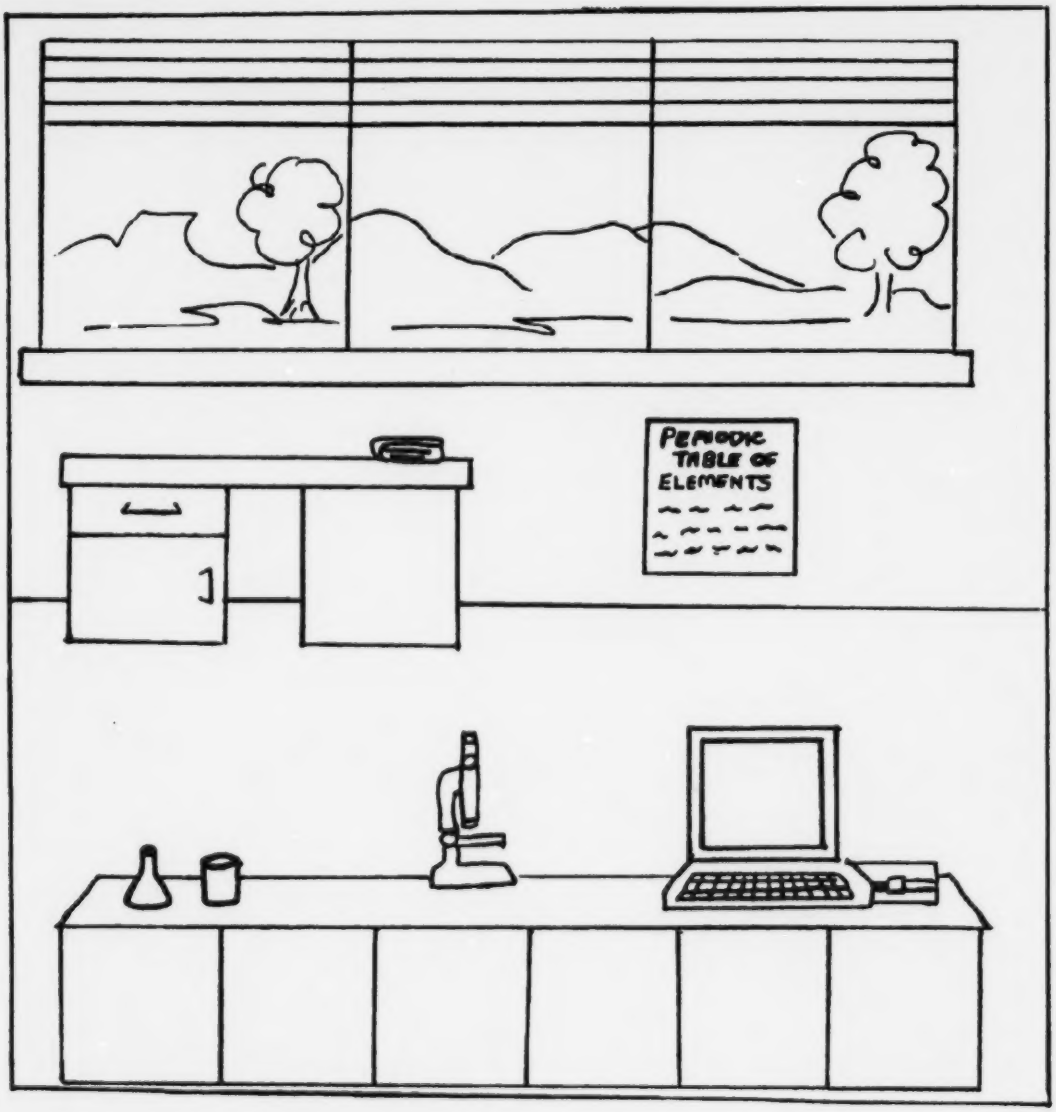
(C)

The student is to choose one to construct.

Shape Search: Squares

The turtles have left the science lab for the night.

Now you can count all of the squares.

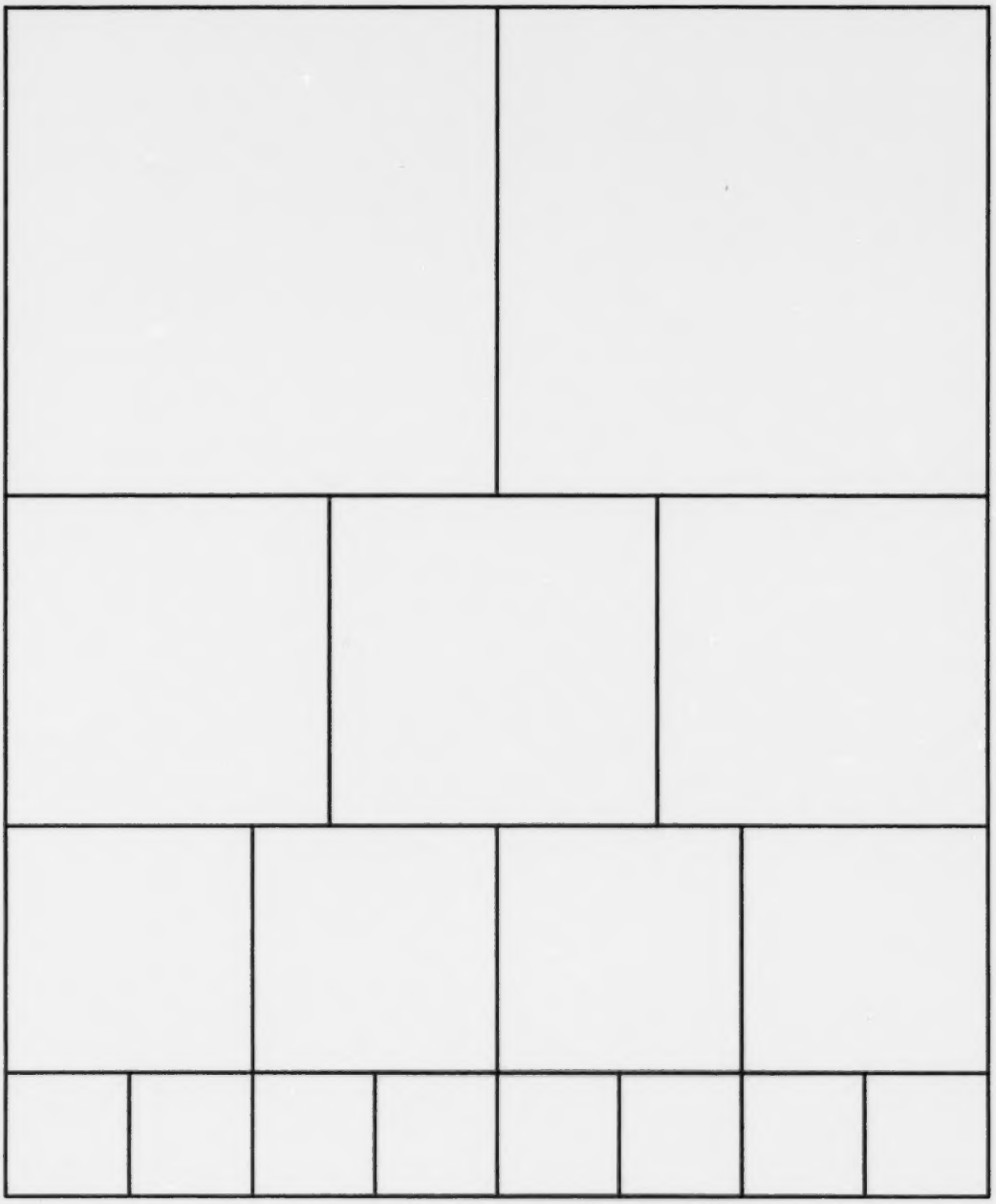


Number of squares _____ .

Now, color the picture.

Square Shapes

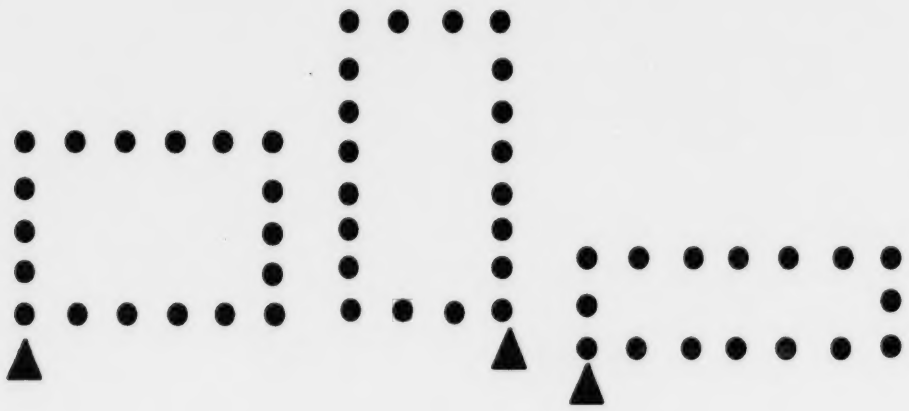
Cut out each of the squares. Paste them on another sheet of paper to make a picture.



Logo Rectangles

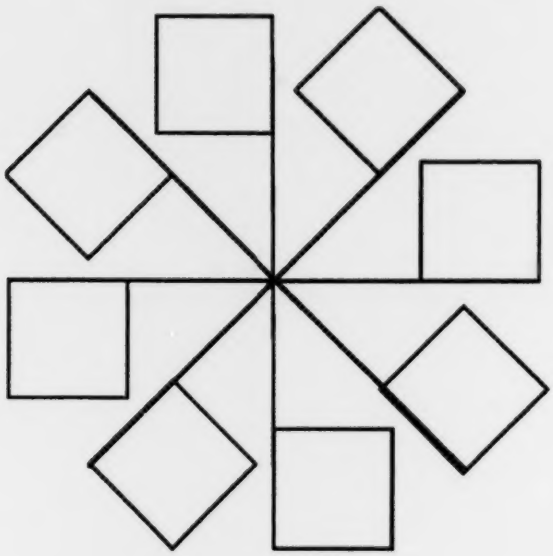
Join the dots to make rectangles.

Fill in the blanks below each rectangle to complete the commands. Begin where each turtle is.

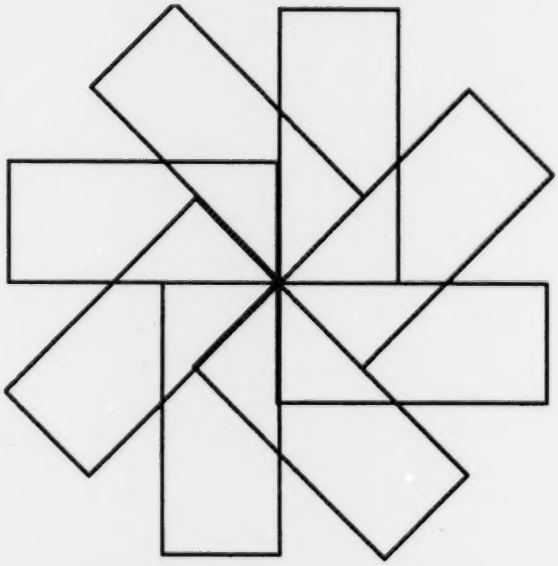


FD 4	FD _____	RT 90
RT 90	LT 90	FD 6
FD 5	FD _____	LT 90
RT _____	LT 90	FD _____
FD _____	FD _____	LT _____
RT _____	LT _____	FD _____
FD _____	FD _____	LT _____
RT _____	LT _____	FD _____

Flags



Pinwheel



Lesson 7. REPEAT

Goals

Students will be encouraged to:

1. Recognize the patterns that allow students to use the REPEAT command.
2. Experiment with REPEAT to draw more challenging graphics.

Implementation

Teacher Talk	Student Activities
1. Play *Einstein's Exercises.*	Game: *Einstein's Exercises*

2. Write the commands for a square on the chalkboard using this format: FD 50 RT 90 FD 50 RT 90 FD 50 RT 90 FD 50 RT 90 Ask the students what shape these commands will produce. Encourage them to identify a pattern. Inform students that there is a shorter way to write these commands that will draw a square and save them time. Introduce REPEAT at this time. Write the following on the board to illustrate this. REPEAT 4 [FD 50 RT 90]. Discuss the use of brackets [ ]. Note: When you use the REPEAT command, it must be followed by a space and a number that specifies the number of times the commands within the brackets will be repeated.	
3. Play *Again Galileo.*	Game: *Again Galileo*
4. Have the students do the worksheets *Franklin's Formula 1* and *Franklin's Formula 2.*	Worksheets: *Franklin's Formula 1* and *Franklin's Formula 2*

5. At the computer, allow students time to explore using any numbers they wish with the REPEAT, FD, BK, LT, and RT commands. Encourage them to share their favorite pattern and to explain the commands they used to create it.	
6. Encourage students to use the REPEAT command to build a stairway out of the sewers. Using the REPEAT command, have them fill the screen with stairs.	Disk: *Stairs*

Game: *Einstein's Exercises*

This game is used to introduce REPEAT. Write the word REPEAT on the chalkboard several times. Ask students to try to figure out what you are doing. Lead them to discover the concept of REPEAT by continuing to write this until someone says, "Again!"

Ask your students to stand and respond to each of your commands. Example:

Slap your knees. (Class responds)

Slap your knees. (Class responds)

Slap your knees. (Class responds)

Now say, "Slap your knees three times." (Class responds) Tell your students that in computer language this would be written as follows: REPEAT 3 [Slap your knees.]

Many other creative commands can be generated for use with the REPEAT command.

Game: *Again Galileo*

Select one student to be the turtle, Galileo. Ask the class to take turns giving Galileo commands using REPEAT. Discuss the commands and movement.

Example:

REPEAT 2 [FD 5]

Then ask: How many steps did Galileo take? (10 steps)

Notes

Franklin's Formula 1

By using the REPEAT command you can help the turtle write the shorter way.

FD 50 RT 90
FD 50 RT 90
FD 50 RT 90
FD 50 RT 90

REPEAT _____ [FD _____ RT _____]

FD 20 LT 90
FD 20 LT 90
FD 20 LT 90
FD 20 LT 90

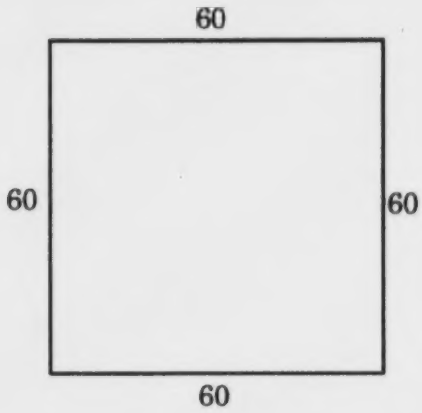
REPEAT _____ [_____ 20 LT _____]

BK 60 LT 90
BK 60 LT 90

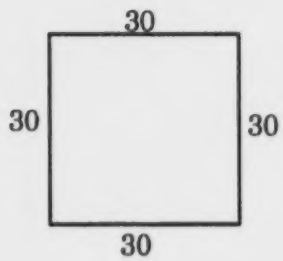
REPEAT _____ [_____ _____ _____ _____]

Franklin's Formula 2

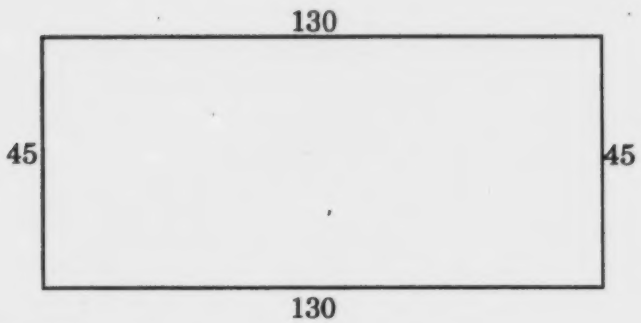
Write the commands for the squares and rectangles.



REPEAT ____ [____ ____ ____ ____]



REPEAT ____ [____ ____ ____ ____]



REPEAT ____ [____ ____ ____ ____ ____ ____ ____ ____]

Lesson 8. PENUP, PENDOWN, and NAMEPAGE

Goals

Students will be encouraged to:

1. Become familiar with the new commands PU (penup) and PD (pendown).
2. Learn the procedure for naming the page and saving the work on that page.
3. Recognize the abbreviated form of the command NAMEPAGE (NP).

Implementation

Teacher Talk	Student Activities
1. Explain to the students that there will be times when it is necessary to move the turtle without leaving a line behind him. To do this, you instruct the turtle to move with his pen up (PU). When you want the turtle to draw again, you instruct it to put the pen down (PD).	
2. Using a clean piece of paper and a crayon, lead the students through a series of PU, FD, and PD commands. Ensure that the students lift the crayon off the page when the PU command is given. This concept can easily be demonstrated by using a manipulative, such as a stuffed turtle with a pen or pencil attached to it.	Paper and crayon exercise

3. Use game on disk: *Edison's Excursions.*	Disk: *Edison's Excursions*
4. Instruct the students to experiment with trying to draw their own initials on the screen. These will be in block form. Encourage students to use the plan sheet before and after they work at the computer. (You may wish to refer to the sample Block Letter sheet at the end of Lesson 5.)	Worksheet: *Galileo's Grid* (from Lesson 5)
5. Enrichment: Draw a cross on the screen.	Disk: *Cross*
6. Explain to the students that there will be times when they will want to save the designs they have created. When they want to save something they press the Escape key (ESC), the key at the top left corner of the keyboard. The computer will then ask them to name the page so that the next time they want to see this page, the computer will know what page to look for.	

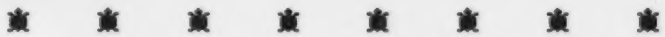
7. To name the page students type NP (space) " _____ (their page name) and then press Return/Enter. Note: There must be a space between NP and the open quotes. Also, the title should be one word. Students will know their page is saved when the title appears on the Contents page. To retrieve this page they must choose it from the Contents page.	

Disk: *Edison's Excursions*

Students use the new commands to draw a dotted line down the middle of the highway, copying the example given.

Disk: *Cross*

A design of a cross is drawn. Students are instructed to try to reproduce it.



Notes

Lesson 9. Other Turns

Goals

Students will be encouraged to:

1. Manipulate the turtle with the LEFT and RIGHT turn commands.
2. Continue to use the abbreviated forms of LT for LEFT and RT for RIGHT.
3. Practice using these commands with a variety of numbers representing degrees.
4. Recognize that the term "bug" refers to an error in the command.

Implementation

Teacher Talk	Student Activities
1. Play the game *Follow Franklin.*	Game: *Follow Franklin.*
2. Use any of the previous activities the students have enjoyed. Use a variety of turns.	Worksheets: *Logo Bug Buster* and *Edison's Explorations*
3. Use a variety of activities with transparencies, worksheets, and games. The mazes can be made into transparencies and taped to the computer screen to line up with the turtle. Students then try to move the turtle through the transparency maze.	Transparencies: *Turtle Tunnels* and *Turtle Tunnels Too* Worksheets: *Logo Bug Buster* and *Edison's Explorations* Games: *Turtle Baseball, Dot to Dot* Disk: *City*

Game: *Follow Franklin*

Review turns of 90° left and right by having the students rotate their bodies. First have the students turn a quarter of a circle. Then use different phrases for a variety of turns of varying degrees. Each time, the student should return to the initial starting position before starting the new commands. The direction of the turns is varied, and the vocabulary "quarter turn," "eighth turn," "three-quarters turn," and so forth is introduced. After students understand the phrases, the number of degrees is substituted for the names. Other ways in which these turns can be taught might include the following:

- A large circle of paper is marked off into quarter and eighth sections. Students stand in the center of the circle and use the lines as turning guides.
- Students extend their right or left arms out to the side and turn to face that direction.

To play the game one student is selected to be Franklin. The other students try to help Franklin return home. Home is a circle drawn on the floor. Obstacles, such as chairs or boxes, are placed between Franklin and home. Franklin is blindfolded and spun around three times before he begins his excursion. The students are asked to estimate how many commands it will take to get Franklin home. They then take turns directing Franklin by using the commands they have learned. You may wish to have someone write down the commands on the board for everyone to see. The game concludes when one of Franklin's feet enters any part of the circle called Home.

Game: *Baseball*

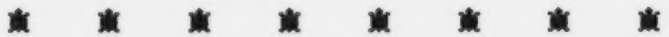
Two students play this game together. The object of the game is to have students move the turtle around the ball diamond in the least number of turns. After one student finishes the game, the second student tries. Students should be encouraged to record their moves.

Game: *Dot to Dot*

Challenge your students by using small, colored gummy dots placed randomly on the computer screen. Number these dots so that students follow them in numerical order, or order them by color coding, e.g., go to the yellow dot first, then to the blue dot, and so on.

Disk: *City*

A city skyline is shown. Students are asked to try to draw a skyscraper skyline.

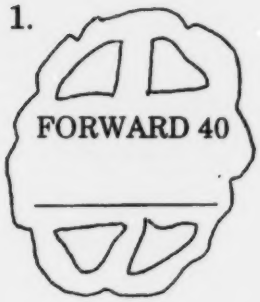


Notes

Logo Bug Buster

Look at each of the commands in the turtle shells. Some of them have "bugs." Can you spot them? Rewrite these commands so that they are correct. If the shell does not have a "bug," color it.

1.



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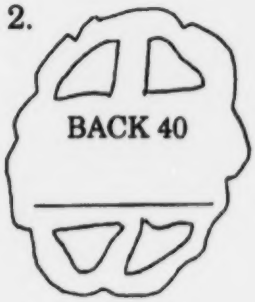

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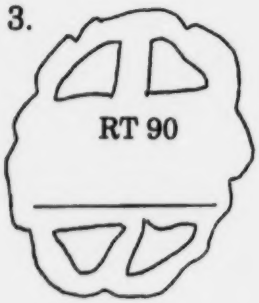

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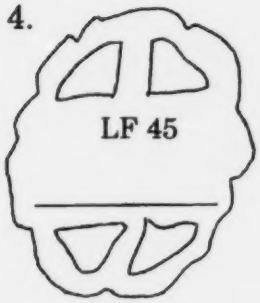

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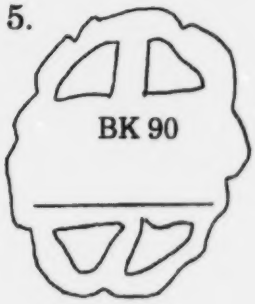

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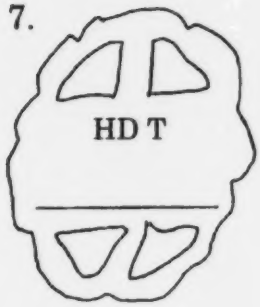

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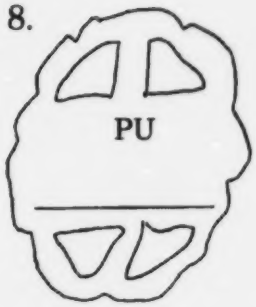

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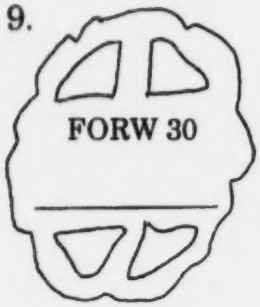


Edison's Explorations

Look at each of the designs below. Write the commands for each design in the spaces below it. Then go to the computer and type your commands. Does the design on the computer match the designs on this sheet? If so, you chose the correct commands.

1.

2.

3.

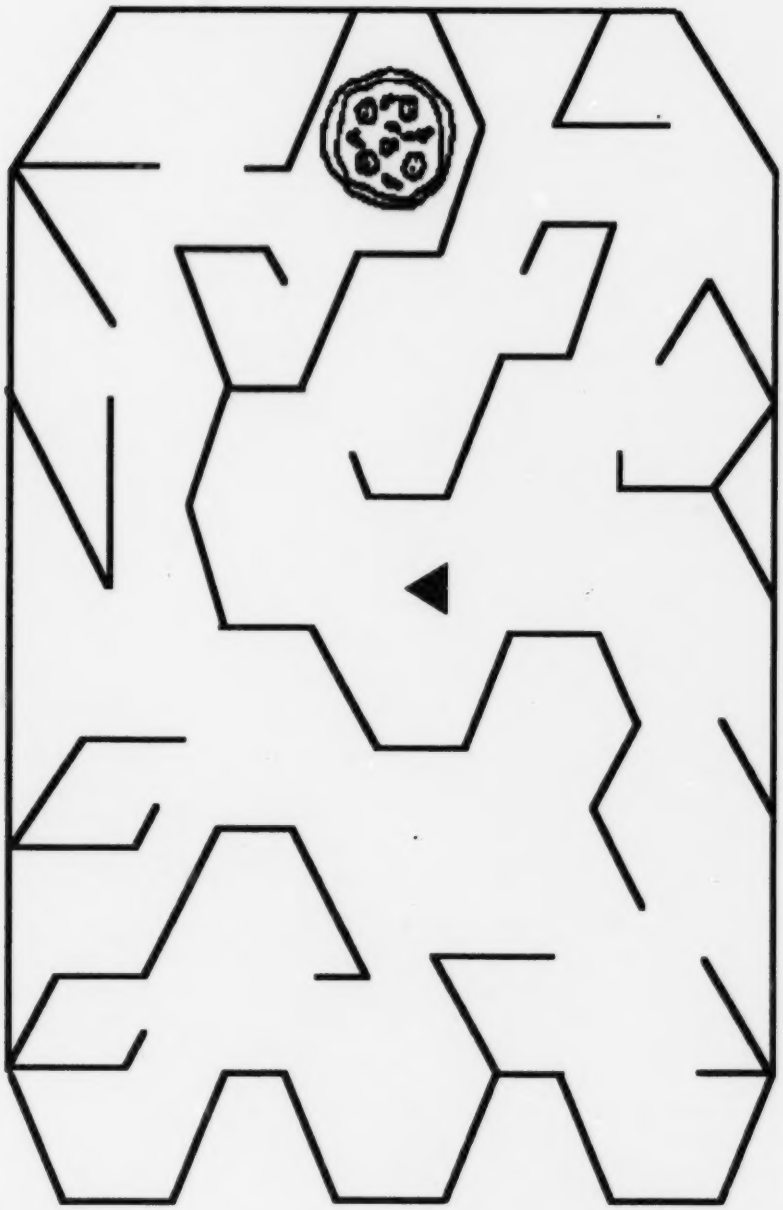
4.

5.

6.

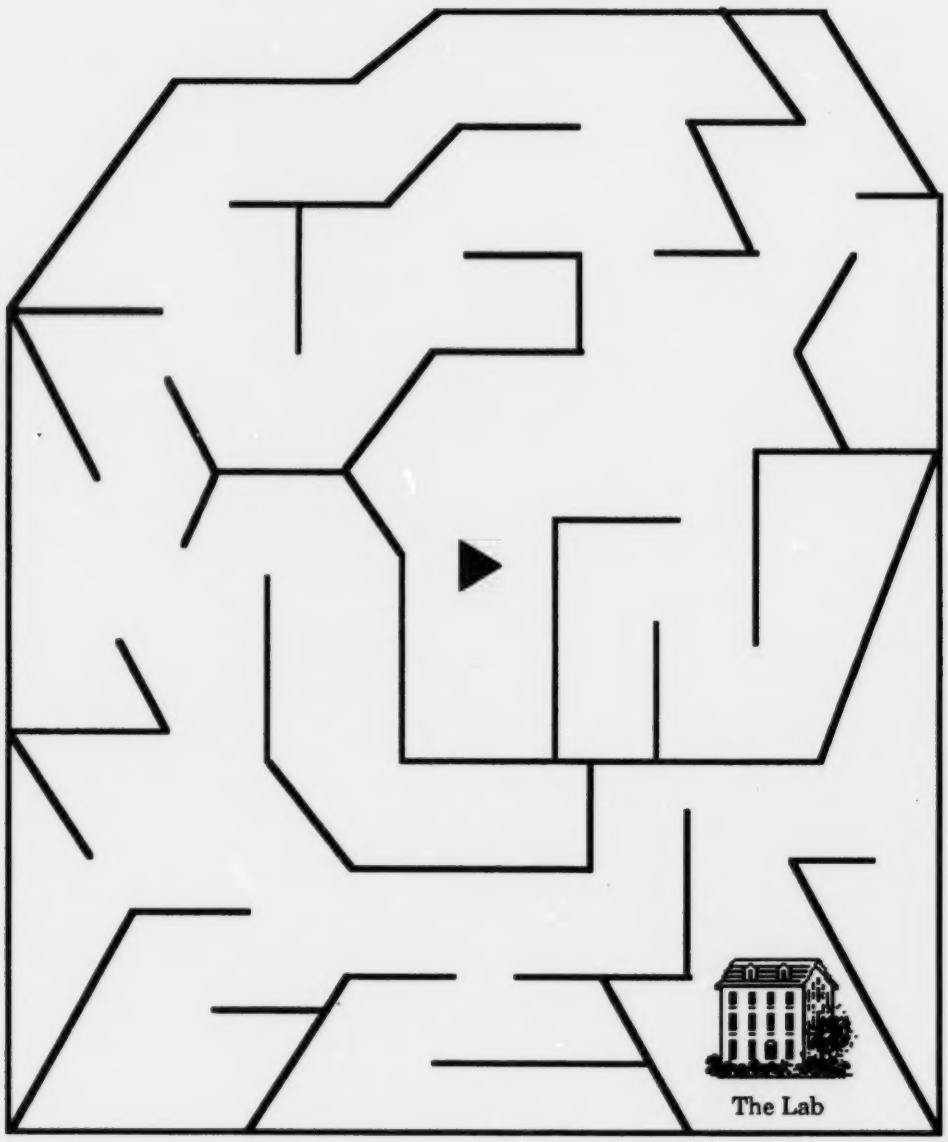
Newton's Turtle Tunnels

Newton is hungry. Help him find his way to the pizza.



Galileo's Turtle Tunnels Too

Help Galileo find his way through the tunnels to the lab.



Lesson 10. Circles

Goals

Students will be encouraged to:

1. Draw circles.
2. Identify the characteristics of a circle.

Implementation

Teacher Talk	Student Activities
1. Begin by discussing what a circle looks like. Ask students to identify objects in the classroom that are shaped like a circle.	
2. As appropriate, students may do the worksheets *Creating With Circles* and *Shape Search: Circles*.	Worksheets: *Creating with Circles* and *Shape Search: Circles*
3. Body geometry: Have a volunteer walk out one of the shapes the class has learned in previous lessons, and have the class guess which shape it is. Then choose another student to walk out a circle, and ask others to walk out different sizes of circles. Next, ask students to choose a shape to walk out; have other students guess the shape and describe the procedure for making it in Logo.	

Note: Lead the students as necessary to discover that a circle has no sides and no corners. Hint: Circles are most accurately drawn when the turtle is instructed to repeatedly move forward a small distance, and then make a small turn, e.g., REPEAT 360 [FD 1 RT 1]. (This is the procedure students should use.)	
5. Try the computer activities provided.	Disk: *Newton* Disk: *Einstein*
6. Enrichment: Copy Task Cards onto colored tag board and cut each sheet in half horizontally to separate the two tasks. Students attempt to draw the shapes on their computers.	Task Card: *Circles* Task Card: *A Slinky* Task Card: *A Curved Slinky*
7. Enrichment: For students who would benefit from the extra challenge.	Disk: *Circles*

Disk: *Newton*

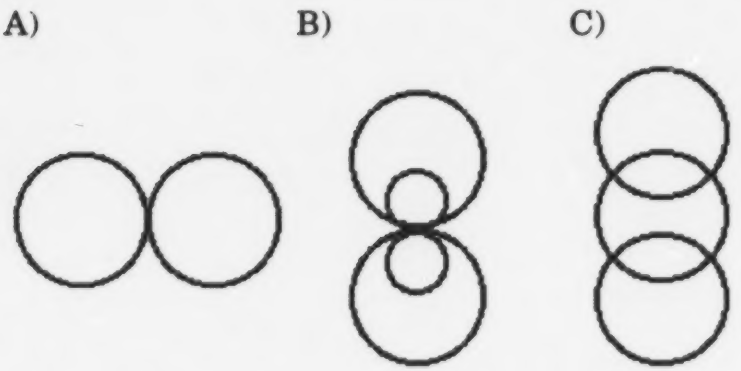
Newton's baby brother is blowing bubbles. Draw many different sizes of bubbles on your screen. HINT: Remember to use PU and PD.

Disk: *Einstein*

A picture of Einstein appears on the screen. Students are asked to draw designs using circles of various sizes.

Disk: *Circles*

There are three activities from which students can choose. At the beginning of the program, students view these three shapes:

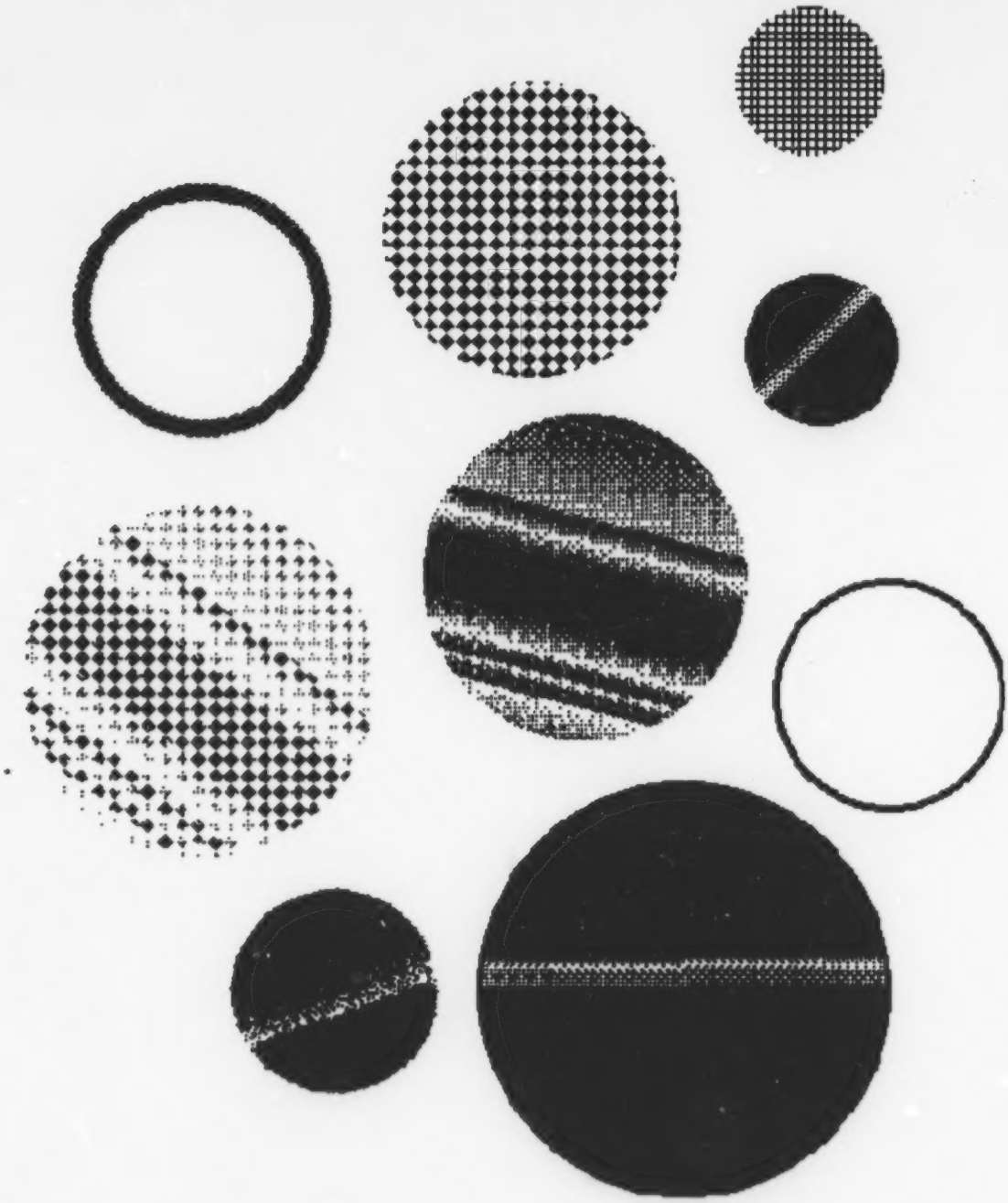


They then are instructed to try to construct A, B, or C. If they make a mistake and wish to start over again, they simply type the chosen letter again. Encourage them to write down the commands that work.

Notes

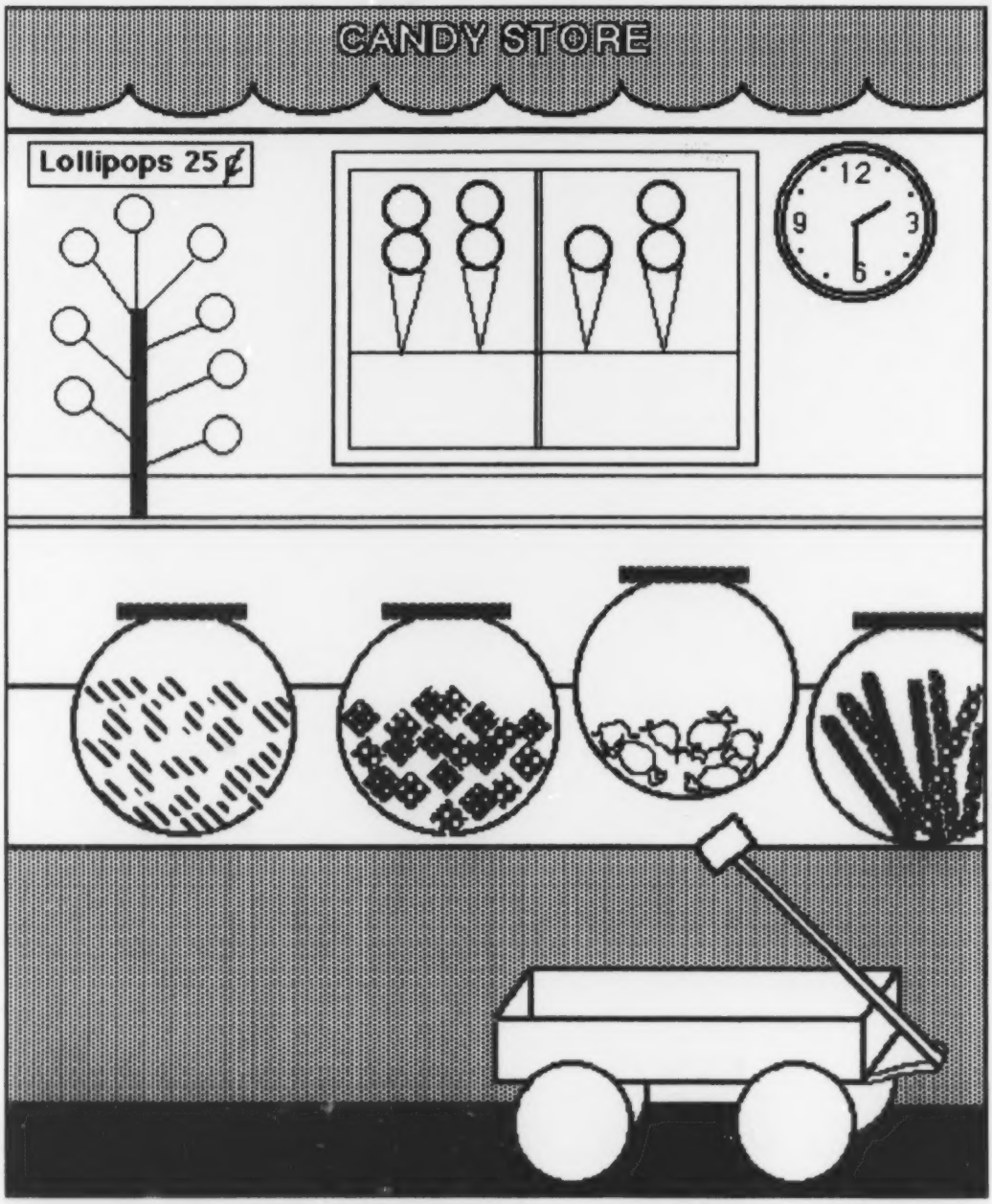
Creating With Circles

Cut out the circles and paste them on a separate piece of paper to make a picture. You can use some or all of the circles. Color your picture.

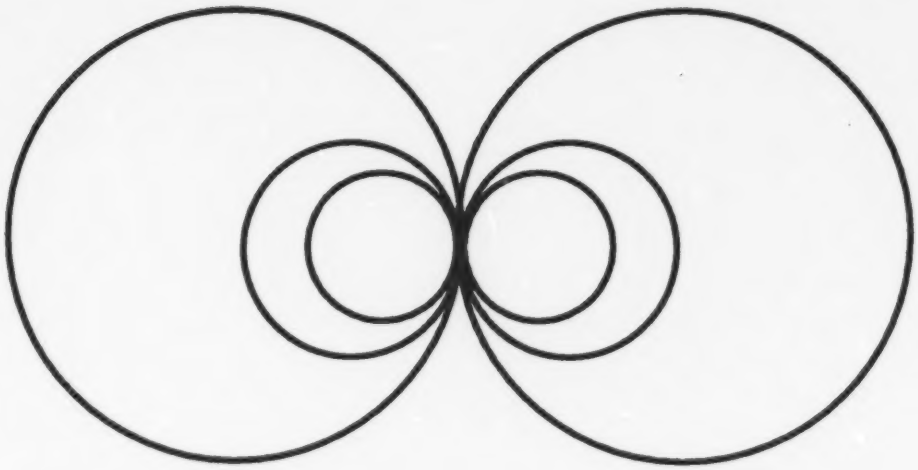


Shape Search: Circles

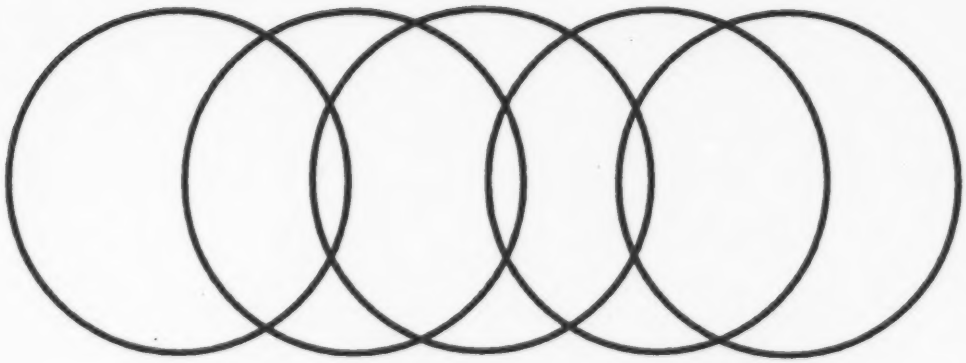
The turtles are shopping for Newton's birthday party. They need some things from the candy store. Help them find all the circle shapes. Color each one you find.



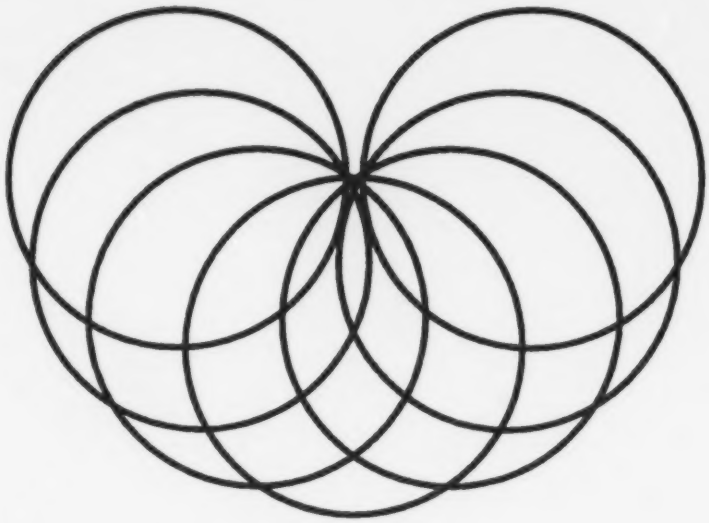
Circles



A Slinky



A Curved Slinky



Lesson 11. Triangles

Goals

Students will be encouraged to:

1. Draw triangles.
2. Identify the characteristics of triangles.

Implementation

Teacher Talk	Student Activities
1. Draw a large circle on the playground or classroom floor. Divide the circle into quarters. At the end of each line place a different object, such as a chair or chalk brush. Choose one student to stand in the center of the circle. Have other students give turning commands to direct this student to face an object. Ask questions such as, "How much would you turn to face the chair? The chalk brush? The chalkboard?"	
Note: Lead the students to realize that we are working with 90° turns and that two of these turns can be put together to make a half circle, or a 180° turn.	

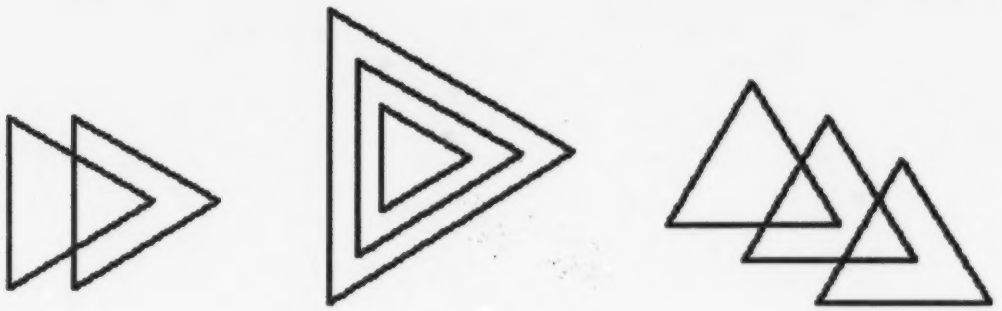
2. Divide each quarter of the circle in half. Explain that each of these sections is half of a 90° turn and is called a 45° turn. These turns are needed to make a triangle. Continue playing turtle as in Step 1 above, incorporating the 45° turns.	
3. Distribute paper squares to each student. Talk about the 90° turns. Demonstrate how to fold the paper in half diagonally to make a triangle. Challenge students to fold and cut the square to make four triangles (or as many as they can).	Squares of paper
4. Assign worksheet: *Pizza Party*	Worksheet: *Pizza Party*
5. Assign worksheet: *Shape Search: Triangles*	Worksheet–*Shape Search: Triangles*

6. Enrichment for students who would benefit from the additional challenge. Transparency instructions: These designs can be made into transparencies and taped to the computer screen. Students then attempt to trace under the lines to re-create the design on the screen. Copy Task Cards onto colored tag board and cut each sheet in half horizontally to separate the two tasks. Students attempt to draw the shapes on their computers.	Disk: *Triangles* Transparency: *Boat* Transparency: *Truck* Worksheet: *Try a Tangram* Task Card: *Cross* Task Card: *Diamond* Task Card: *Pennants*

Disk: *Triangles*

There are three activities from which students can choose. At the beginning of the program, the students view these three shapes:

A) B) C)



They are then instructed to try to draw A, B, or C.

Notes

Pizza Party

Just like the other turtles, the Brainy Bunch loves pizza. Think of some toppings for pizza and draw some on this pizza.

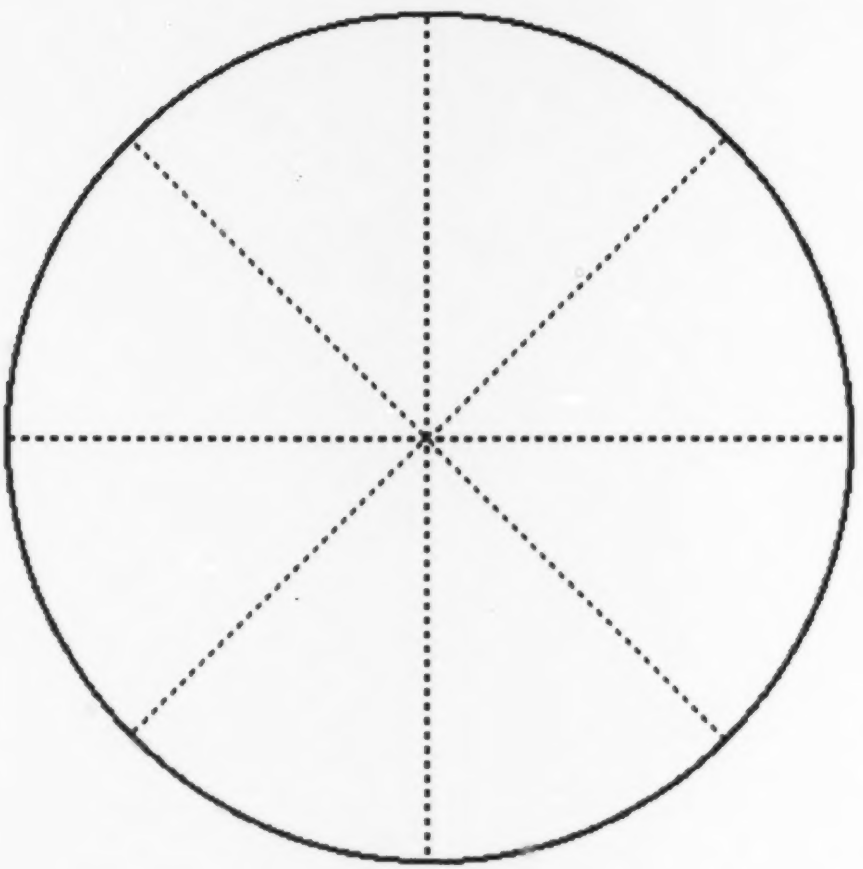
Cut out the pizza shape.

Now cut the pizza in half from top to bottom.

Cut each of these pieces in half. These make a 90° slice. Can you see the magic turn?

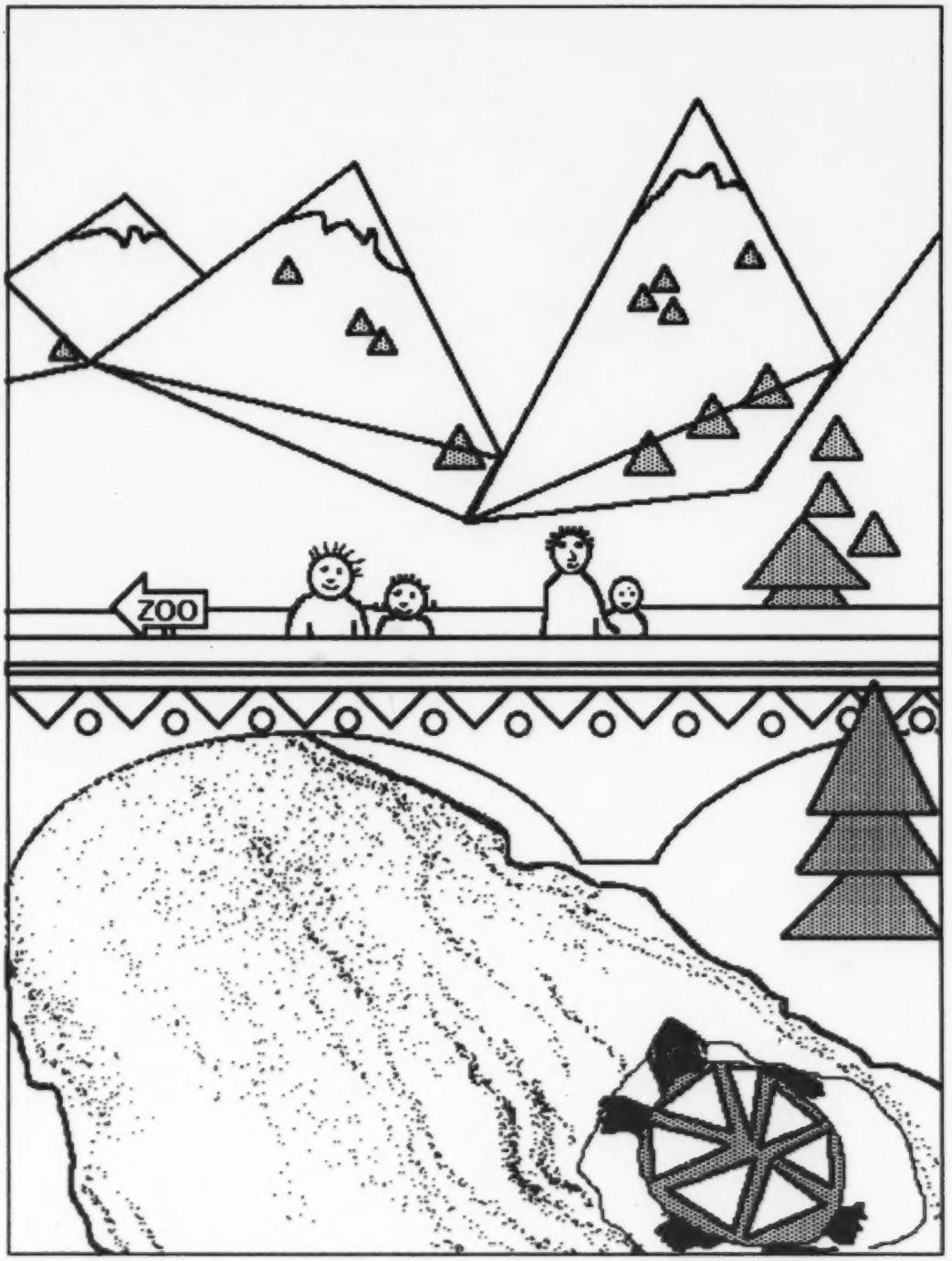
Now cut each of these quarter pieces in half. These make a 45° slice. Two of them make a 90° slice.

Can you put the pizza together again?

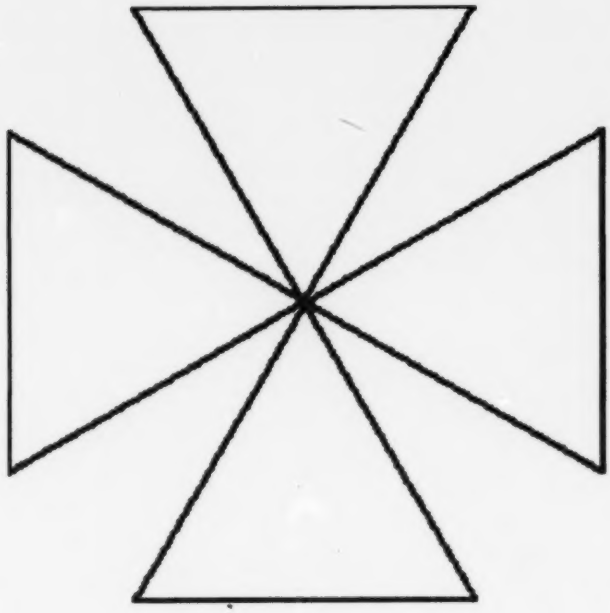


Shape Search: Triangles

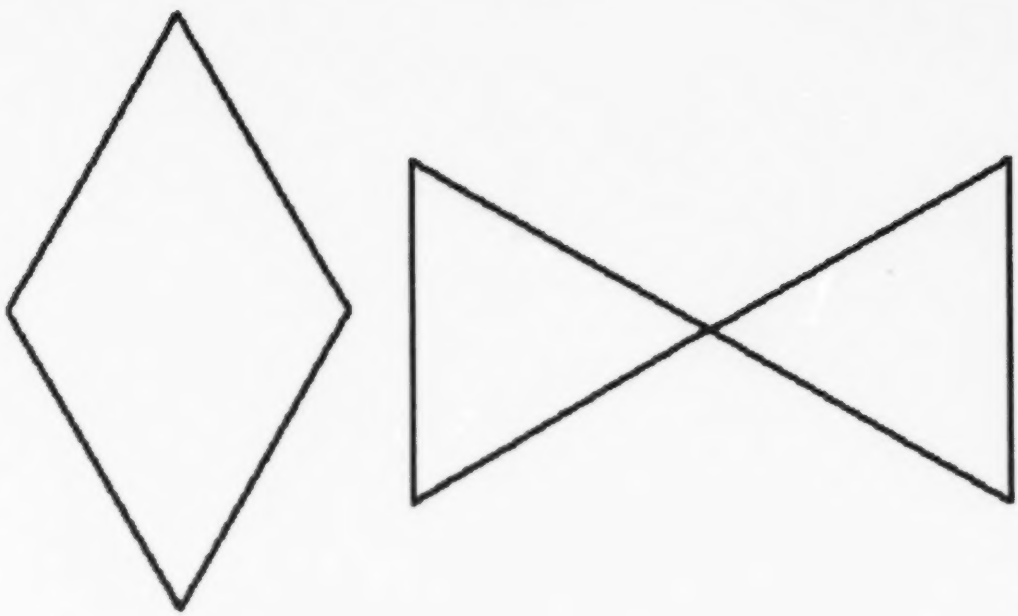
All the turtles are going to the zoo. Today they are looking for triangles. Color all the triangles you can find.



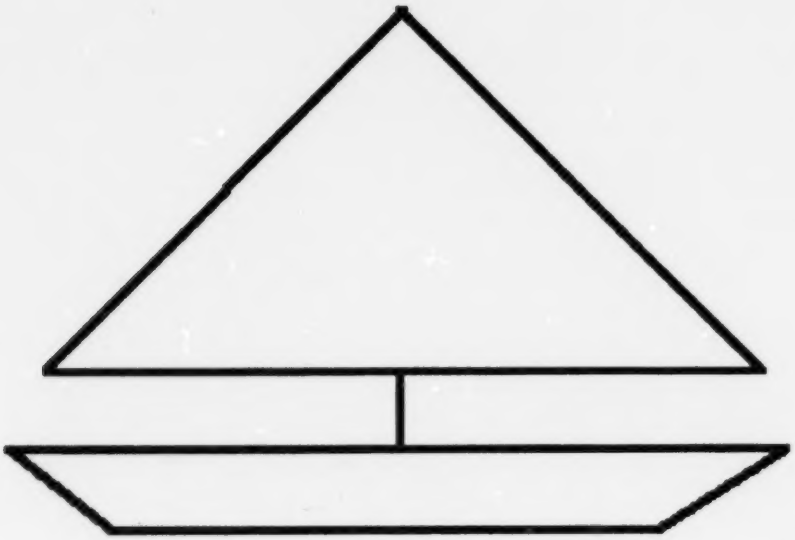
Cross



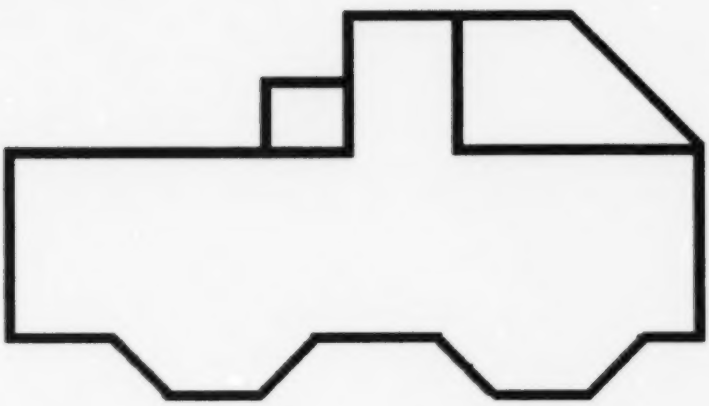
Diamond



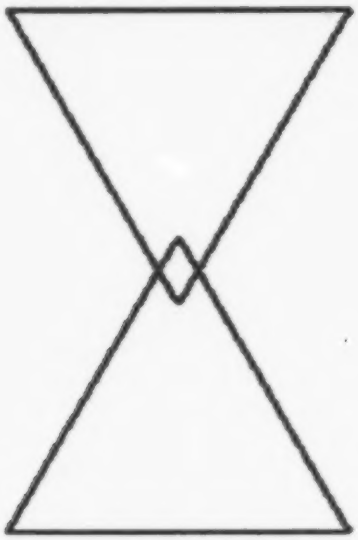
Boat



Truck

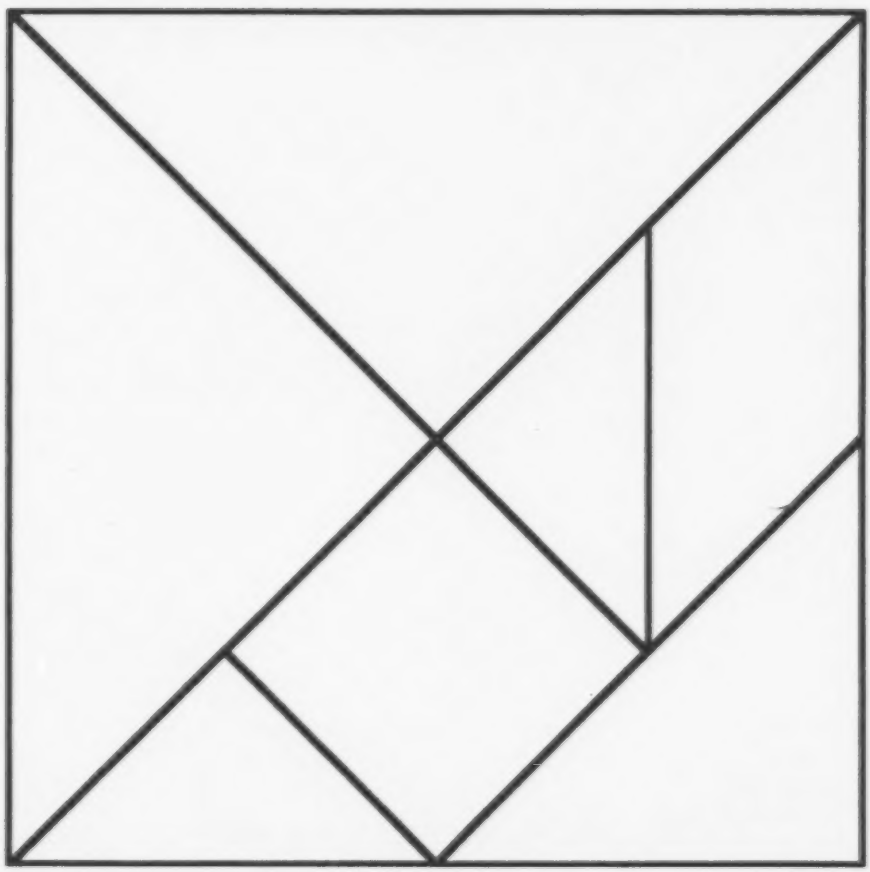


Pennants



Try a Tangram

1. Cut out each piece.
2. Try to put the pieces together again to make the big square.
3. Now make a picture using the parts of the tangram.
   Glue them onto another piece of paper. Add details.
   Color your picture.



Lesson 12. Color

This lesson is optional. It requires the use of a color monitor to be effective.

Goals

Students will be encouraged to:

1. Use the command SETCOLOR (SETC) to change the pen color.
2. Experiment with filling a shape with color.

Implementation

Teacher Talk	Student Activities
1. Explain to the students that they will be able to change the color of the pen that the turtle draws with by using the command SETC followed by a number. Display a chart with the pen colors of your computer.	

2. Allow one student at a time to play the turtle. Using either paper and felt-tip pens on the floor or colored chalk on the chalkboard, have students instruct the turtle to draw a specific shape after setting the pen color, e.g., SETC 5 Draw a square. (Student draws a blue square). Note: Only the outline of the shape should be drawn in color. The shape will not be colored in at this time.	
3. On the computer, encourage students to explore drawing shapes with various colors.	

4. Have students clear their screens and draw a large square. Inform them that instead of just outlining in color, the turtle can also fill a shape with color. The command they will need is FILL. To fill they must first use PU and move the turtle away from the edge of the square to the inside of the shape. *(A shape will not fill with color until the turtle is moved away from the outline).* Once the turtle is no longer touching any edge, the command PD should be given. Now the student must choose the color (SETC and a number) and then type FILL. The shape will fill with the color chosen.	
5. Encourage the students to explore the use of this new command with the previous shapes learned. Challenge the students to draw four different shapes and fill each with a different color. Then try the disk activity.	Disk: *Birthday*

Disk: *Birthday*

Students will see a picture of a birthday party scene. They are to color in the shapes with the colors of their choice.

Notes

Lesson 13. Combining Skills

Goals

Students will be encouraged to:

1. Demonstrate their understanding of the commands learned.
2. Work on a project that incorporates these commands.

Implementation

Teacher Talk	Student Activities
1. Teachers may choose from the variety of projects suggested below.	

Activity: *Curie's Comforter*

Each student is instructed to draw a large square on his or her screen. (They must all be the same size.) Suggested commands might be:

```
PU
BK 80
PD
REPEAT 4  FD 160  RT 90
```

Each student may create his or her own design inside the square. This may include color if a color printer is available. After designs are complete and printed, they may be cut out and mounted on a bulletin board as a quilt. If a color printer is not available, students may wish to color these in.

Activity: *Curie's Creature*

Instruct the students to design a weird and wonderful creature on their screen. They may wish to save this because they can use it as part of a later lesson on adding text.

Activity: *Mirror Mirror*

Students choose a simple picture from your file on symmetry or from a simple coloring book. Cut the shape in half and tape one half to the left side of the computer screen. The task is to complete the picture by drawing the other half.

Activity: *Turtle Town*

Encourage each student to draw a uniquely shaped building with interesting details. After these buildings are printed, they can be mounted on a bulletin board to create a town. Other details, such as streets and trees, can be drawn in to make the town appear more realistic.

Disk: *Garfield*

A picture of Garfield's face is drawn on the screen. Students are asked to duplicate it by drawing Garfield's face beside the original.

* * * * * * * *

Notes

Lesson 14. Shapes

Up to this point, students have been constructing their own graphics on the computer. This lesson allows students to use a set of shapes already provided with the *LogoWriter* program.

Goals

Students will be encouraged to:

1. Familiarize themselves with the SHAPES page.
2. Change the turtle into a chosen shape using the SETSHAPE command (SETSH).
3. Experiment with the STAMP command.

Implementation

Teacher Talk	Student Activities
1. Explain to students that they will be able to change the shape of the turtle by using the command SETSH followed by a number between 1 and 30. Encourage students to try a variety of numbers with the SETSH command. Note: Depending on the level of *LogoWriter* you are using, some of the numbers are just dots while others are predetermined shapes. The Scrapbook disk accompanying this disk includes some shapes.	

2. After the students experiment, inform them that the shapes they can choose from are found on the Shapes page. Guide them to choose the Shapes page from the Table of Contents. Discuss the shapes with them.	
3. When drawing a scene with the shapes, students will need to understand that the STAMP command is used to leave a shape on the screen. The sequence of commands to follow in stamping a shape is as follows: a) PU and the necessary commands to move the turtle to the desired position b) SETSH, followed by the number of the shape you want c) PD d) STAMP e) PU and commands to move the turtle to another position Repeat this pattern as often as necessary or desired.	

4. Try the computer activity: *Try.Stamping.*	Disk: *Try.Stamping*
5. Challenge students to make a border using the following set of commands: a) HOME RT PU BK 80 LT 90 FD 130 RT 90 SETSH followed by shape number PD STAMP REPEAT 7 [PU FD 23 PD STAMP] RT 90 REPEAT 11 [PU FD 23 PD STAMP] RT 90 REPEAT 7 [PU FD 23 PD STAMP] RT 90 REPEAT 11 [PU FD 23 PD STAMP]	Disk: *Try.Border*

Note: This seems long and involved but students love to play with it once they learn how to do it. In later lessons, you might teach them how to put this into a procedure. Also, if you wish to include text or another picture with the border, be sure to pick your pen up before continuing.	
6. Try the computer activity: *Try.Border.*	Disk: *Try.Border*
7. Enrichment: Copy Task Cards onto colored tag board and cut each sheet in half horizontally to separate the two tasks. Students attempt to draw the shapes on their computers.	Task Card: *Kite* Task Card: *House* Task Card: *Teddy Bear*
8. Enrichment: Encourage the students to try some of the ideas listed below.	

Activity: *Initials*

Students choose a shape and stamp their initials in block form. Remind students to use PU and PD.

Activity: *Be an Artist*

Students create a picture using a variety of shapes.

Activity: *Treasure Map*

Students create a map of an island or a town using various shapes.

Activity: *Street Scene*

Using both shapes and graphics, students design a street scene. Examples: a florist shop, a pet store, and a garage.

Disk: *Try.Stamping*

The beginnings of a street scene are drawn on the computer. Have students complete the scene by stamping any or all of the following:

a) more houses

b) more trees (a forest)

c) a flower garden

d) some animals

e) some cars or trucks

f) a train

g) a helicopter

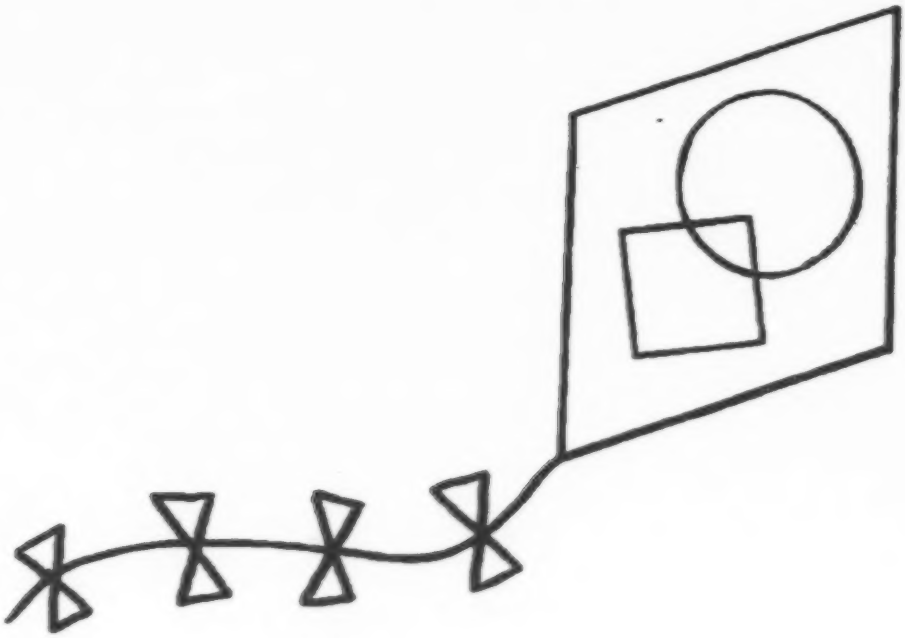
Disk: *Try.Border*

A partial border appears on the screen. Students are instructed to complete the border by stamping the shape that appears.

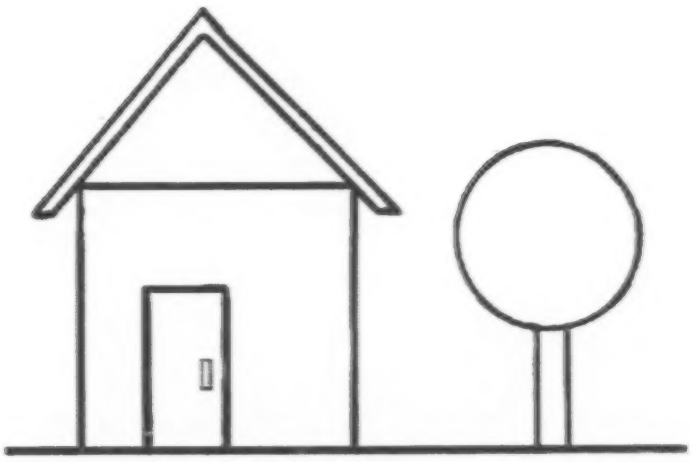
Note: The instructions provided in number 6 of Teacher Talk will create a complete border for Apple computers. You will need to adjust the numbers to accommodate your screen size.

Notes

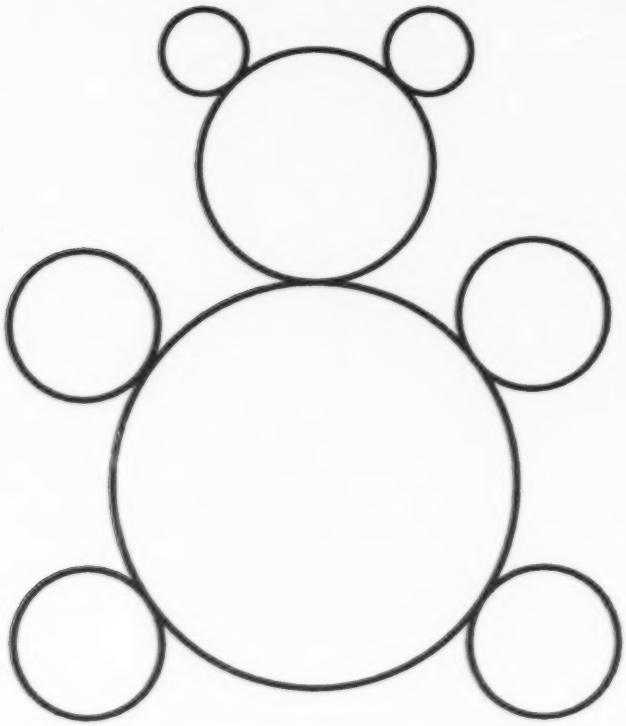
Kite



House



Teddy Bear



Part 3.

Art Ideas and Related Activities

Art Idea: *Make Your Own Computer*

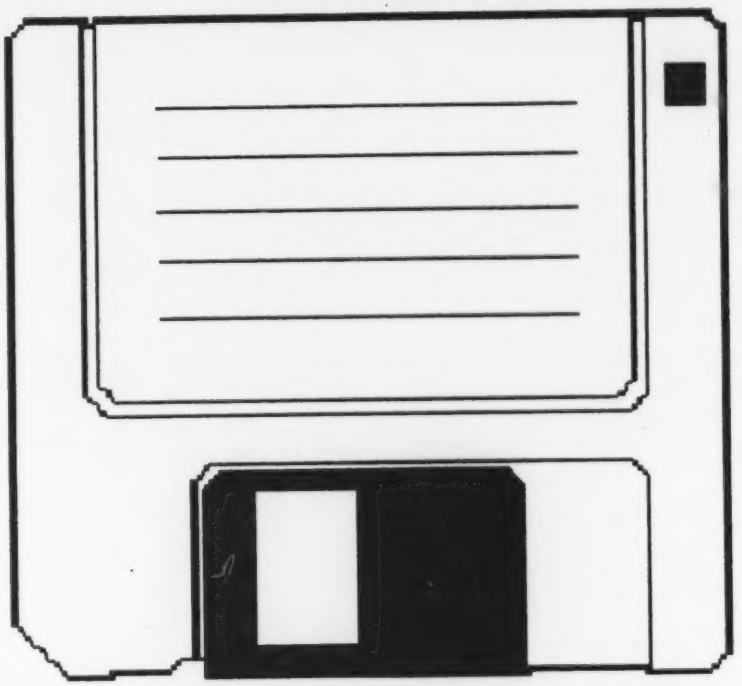
A book entitled *Make Your Own Computer,* by Teacher Created Materials (1984, pages 14-33), contains student pages of plans to make your own computer system from various sizes of boxes and common containers. The monitor is made from a soap box, the CPU from a cereal box, the keyboard from an egg carton, a floppy disk from cardboard, and the printer from a large tissue box.

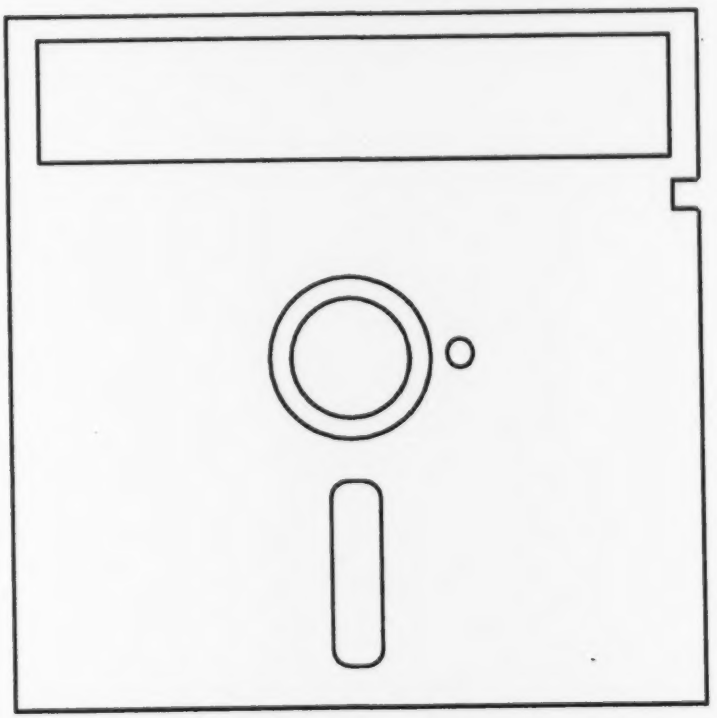
The book provides careful instructions as well as many worksheets in guiding students to create their own imaginary system. If you can find the time, this is an excellent way to familiarize students with correct computer terminology as well as the functions of each part.

Art Idea: *Disk Name Tags*

Students can make their own disks from light cardboard. These can be attached to a string and used as nametags. We have included a pattern on the accompanying worksheet for both 3 1/2" and 5 1/4" disks:

Disk Name Tags





Art Idea: *Turtle Rubbings*

Materials

Anaglypta paper, pencil, scissors, thin cardboard, thin paper, paper clips, and wax crayons.

Procedure

Draw a shape of a turtle on the anaglypta paper and cut it out.

Place the shape on the cardboard.

Put the thin paper over the shape and attach it with paper clips.

Rub different shades of crayon over the paper until the shape appears.

The background can then be painted so that the shape stands out.

Art Idea: *Egg Carton Turtle*

Materials

A large margarine tub, papier mâché, egg carton sections, glue, newspaper, cardboard, craft knife, adhesive, paints, and brush.

Procedure

Cover the tub with two layers of papier mâché.

Attach egg box sections to the tub with pasted strips of newspaper, followed by another layer of papier mâché.

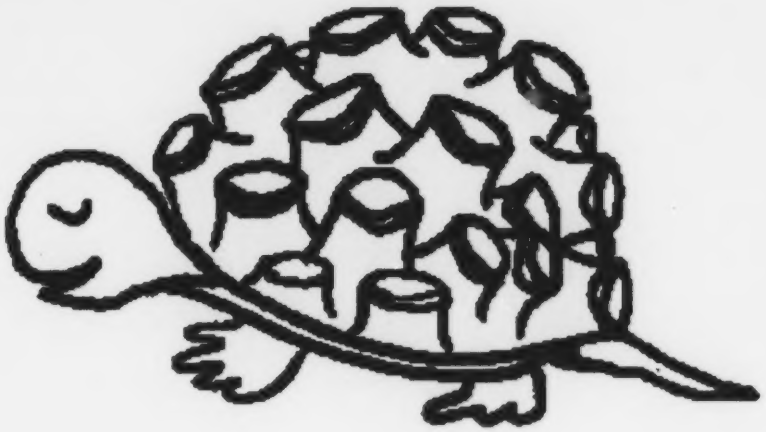
Allow to dry.

Cut out a head, legs, and a tail from cardboard.

Cut vertical slits in the tub to hold the head and legs in place.

Attach the head under the rim of the shell and secure all card additions with adhesive.

Paint the turtle.



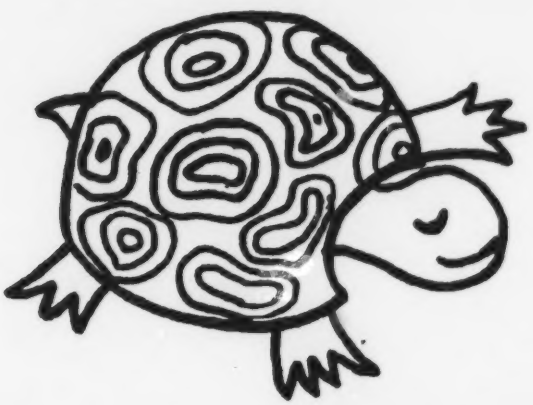
Art Idea: *Turn Turtle*

Materials

An old tennis ball or polystyrene sphere (for larger turtles), or table tennis ball (for small turtles), strong cardboard, pencil, scissors, glue, cork, sandpaper, paints, and brushes.

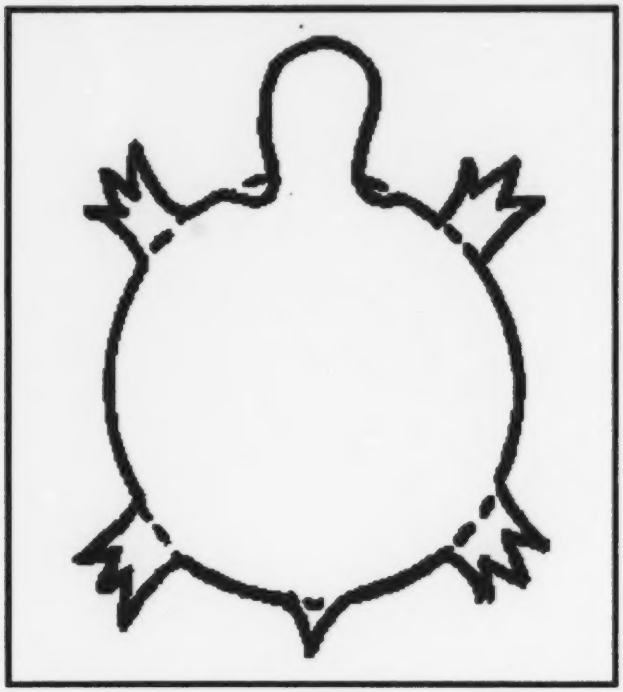
Procedure

Cut the ball in half with either a hacksaw or scissors. Put one half of the ball on the cardboard and trace around it, adding shapes of legs, head, and a tail.



Cut out the shape and fold down the legs (see *Figure A*).

Figure A



Trim a little from the cut edge of the ball to allow space for the head. Glue the half ball to the card.

Shape the cork into a head by rubbing it on sandpaper. Glue it into position and paint your turtle.

Activity: *Play Dough Turtles*

2 cups salt (500 ml)

2 cups flour (500 ml)

1/2 cup oil (125 ml)

1/2 cup water or a little more (125 ml or a little more)

Food coloring or dry tempera

Mix salt, flour, and oil with your hands.

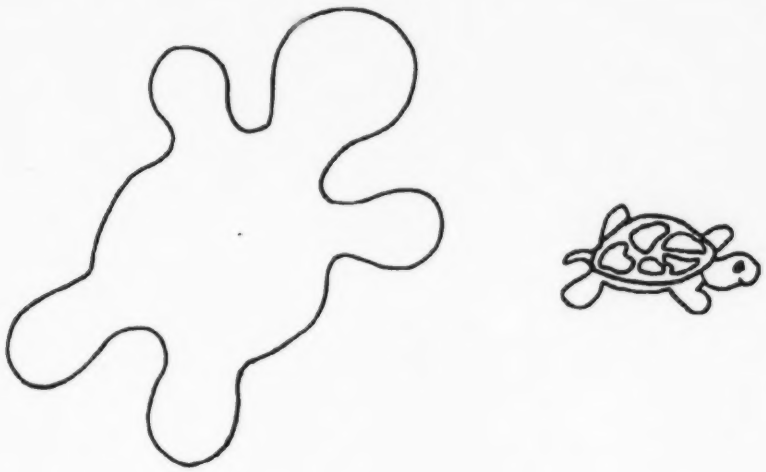
Gradually add water and keep mixing until the dough is not too sticky.

Mix in a few drops of some color.

Use the dough to model and keep the rest in a covered container in the refrigerator.

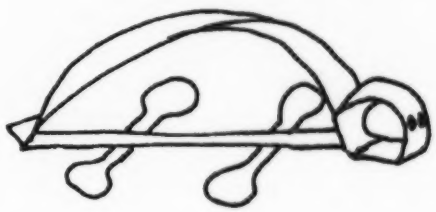
Activity: Walnut Turtles

Glue half of a walnut shell to an outline of a turtle shape made from felt fabric or construction paper. Details can be added with felt markers and eyes purchased from a craft shop.



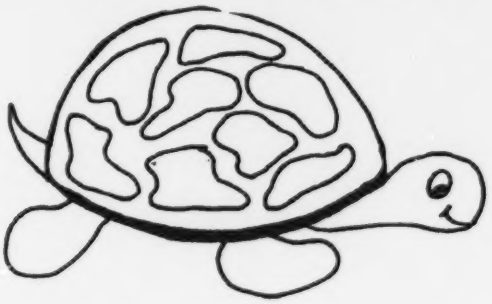
Activity: *Paper Strip Turtles*

Fold one long strip of paper and then glue as shown below. Add details with other smaller pieces of paper to create the turtle. Complete the turtle by using a felt marker to draw in eyes.



Activity: *Transparent Turtle Mobile*

Cut several turtle shapes from black construction paper. Cut out holes in the shape, leaving black between each hole. Cut pieces of colored cellophane large enough to cover each hole. Glue the cellophane to the black edges. Glue a second black turtle shape to the side where the cellophane was glued. Punch a hole near the top and hang with yarn or string.



Activity: *Paper Plate Turtles*

Use a half or whole paper plate as the turtle's body. Add other turtle parts made from paper. Paint your turtle.

Recipe: *Turtle Cookies*

1/2 cup packed brown sugar (125 ml)

1/2 cup margarine or butter, softened (125 ml)

2 Tbsp (approx.) water (30 ml)

1 tsp vanilla (5 ml)

1-1/2 cups all-purpose flour (375 ml)

1/2 tsp salt (2.5 ml)

Pecan halves

8 caramels, each cut into fourths

Chocolate Glaze (recipe follows)

Preheat oven to 350°F (180°C)

Combine brown sugar, butter, water, and vanilla and mix until blended. Add flour and salt and stir until the dough sticks together. If dough is too dry and crumbly to handle, add a small amount of water.

To form each cookie, place a group of 3 to 5 pecan halves on an ungreased cookie sheet. Shape a teaspoonful of dough around a caramel piece and firmly press onto the group of nuts.

Bake 12-15 minutes until set or golden. Cool. Dip tops of cookies into chocolate glaze.

Chocolate Glaze

1 cup confectioner's sugar (250 ml)

1 Tbsp water (15 ml)

1 oz melted unsweetened chocolate (cooled) (28 ml)

1 tsp vanilla (5 ml)

Combine all ingredients in a mixing bowl and beat until smooth.

Recipe: *Tangy Turtle Punch*

1 pkg lime Jello (4 serving size)

1 cup hot water (250 ml)

2 cups cold water (500 ml)

1 (6 oz) can frozen lemonade (177 ml)

1 can pineapple juice

1 qt ginger ale (1 litre)

Lime sherbet

Dissolve Jello in hot water, add cold water, lemonade, and pineapple juice. Mix well. Stir in ginger ale just before serving. Pour over ice in punch bowl. Float sherbet balls on top.

Recipe: *Lemon-Lime Punch*

1 pkg lemon-lime Kool Aid, prepared

1 pkg powdered lemonade, no water added

1 12 oz. can of frozen lemonade, no water added

1 12 oz. can of water

28 oz pineapple juice (840 ml)

1 large bottle of ginger ale

Combine all ingredients. Makes 4 gallons (approx. 15 litres).

Recipe: *Individual Turtle Pizzas*

1 8-oz package refrigerator biscuits flattened to 4" circles

or

English muffin, split and lightly toasted

Pizza sauce

Toppings of your choice—sausage, ham, green pepper, tomato, pineapple, grated cheese

Top biscuits or muffins with sauce. Add toppings and cheese. Bake until brown.

Part 4.

Resources

The Disk

This book is designed to be used with Primary *LogoWriter*. If you wish to have students save their work at any time, they will need a Scrapbook disk. The *LogoWriter* manual tells you how to create such a disk and how to use it.

We have included our own Scrapbook disk with this package. Please feel free to make as many copies of this disk as you need for your students. On it are programs referred to in this book. You will find the following files:

BASEBALL

BIRTHDAY

CIRCLES

CITY

CROSS

EDISON'S.EXCURSIONS

EINSTEIN

GARFIELD

NEWTON

PARTY.PATH

RECTANGLES

STAIRS

TRIANGLES

TRY.BORDER

TRY.SQUARES

TRY.STAMPING

WRAP.IT.UP

The order and titles may vary depending on the computer used (Apple, MAC, IBM, etc.).

A Few Tips

A. When an activity has been completed, and prior to escaping back to the Contents page, it is advisable to clear the Command Center. Type CC and press Return/Enter. That will tidy up the page for the next user. The program automatically will clear the graphics screen.

B. When students are ready to save their work, a review of the lesson on naming the page may be in order (see Lesson 8).

C. When saving a page, it is best to always give it a new name rather than using the same name repeatedly. A new name will ensure that a new file is opened so that the computer will not erase or save over the old file.

D. To print a paper copy of what is on the disk, follow these steps:

1. Select the desired name from the Contents page.

2. To print graphics, allow the picture to be completed on the screen. Wait for the flashing cursor, then type PRINTSCREEN and press Return/Enter. (Be sure your printer is set and ready.)

3. To print the list of instructions on the flip side of the disk, press the Flip key. Move the cursor down to the Command Center by pressing the Down key. Type PRINTTEXT and press Return/Enter.

4. To print only one in a series of pictures, the program must be stopped at the appropriate spot. Press the Stop key to stop the turtle. Then type PRINTSCREEN and press Return/Enter. The printer will print the picture that appears on the screen.

Turtle Commands

FORWARD	FD
BACK	BK
LEFT	LT
RIGHT	RT
HOME	
PENUP	PU
PENDOWN	PD

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Creating a Logo Environment

Tim Riordon

Author's Note: *Perhaps you are a curriculum specialist, school principal, or classroom teacher interested in introducing Logo in your district, school, or classroom. You've done some reading and have a grasp of the philosophy. Now, however, it's time to implement your ideas. How do you actually create a Logo environment? This article bridges the gap between theory and the beginning of actual practice.*

The training in Logo that many teachers are receiving focuses upon learning the Logo language. In four hours, a day, or perhaps a week, teachers begin learning to use Logo commands to write procedures to do wonderful things—graphic designs, music, robot control, random poetry, arcade-like games, and so forth. This training is necessary, but not sufficient, for most teachers to use Logo as it was intended. Most teachers not only need to learn the language but also to learn how to *implement* Logo—how to create a Logo environment in the classroom.

This article examines five questions:

- What is a Logo environment?
- What are its attributes?
- What things are conspicuously absent in a Logo environment?
- What are the reasons for creating such an environment?
- How does one begin?

Ideally, a Logo environment would have a number of computers with many students doing Logo at the same time. However, such environments will not occur in most schools until school districts begin to pool computer resources and lend individual teachers sets of machines for teaching Logo. Therefore, this article is written for the classroom teacher

who has only one computer and wishes to create a Logo environment.

What Is a Logo Environment?

It is the entire context, made possible and managed by the teacher, in which students work with Logo. It is more than a computer learning station. It includes psychological as well as physical space—how students feel, how students and adults interact.

What Are the Attributes of a Logo Environment?

What would an observer see, hear, and feel in a Logo environment? Suppose an omnipresent observer—perhaps a principal doing an evaluation—were to spend a week in a classroom with 25 students, one computer, and a Logo environment. What would he or she observe?

It is Monday morning. The teacher and students have not yet arrived. In the front corner of the room, not far from the teacher's desk, is a table with two chairs, a computer with a disk drive, a large television monitor, and supplies. Supplies include masking tape, rulers, graph paper, pencils, felt-tip pens, and drawing paper. There is a box with three disks in it labeled "LOGO STORAGE DISKS." A small weekly schedule shows each day divided into 20-minute periods. The schedule is nearly filled with students' names. The words "Whole Class" appear four times on the weekly schedule. Each student uses the computer three times per week while the rest of the class continues with other instructional activities. On one wall is a chart with student names down one side and several projects listed across the top of the chart. Many students have checked off projects after their names. Above the chart is the sign "TRY TWO OF THESE PROJECTS THIS WEEK," a direction that seems to invite students without commanding or threatening. On the other wall are some computer printouts of student designs signed by the student programmers. There are also drawings done in felt-tip pen—some by students, some by the teacher. These drawings are on a section of the wall labeled CAN YOU MAKE THE COMPUTER DO THIS? This is a problem-solving environment. There appears to be a sharing of

authority because both students and the teacher are allowed to contribute to the collection of problems. On the floor are many designs made with masking tape. What purpose do these serve?

The teacher arrives and removes some of the drawings from the walls. Four new problems are posted. Three of them are designs and one is a question: "CAN YOU WRITE A LOGO PROCEDURE THAT WILL PUT YOUR NAME INTO A CODE?" The students are evidently using Logo for more than graphics exploration.

School begins, and students, sometimes alone and sometimes with a partner, go to the computer at their assigned times. For the most part, transitions are smooth. Kids are eager to get to the computer, reluctant to quit and store their unfinished business. Once, the teacher has to intervene: "Mary, you really must finish now. It's Kevin's turn. There's some open time at lunch recess I'll let you use if you wish." During the time each student works at the computer, the teacher finds a few minutes to watch and sometimes, seeing a student encounter an unexpected result, asks quietly, "Do you have a theory about what caused that?" Most interaction with students about their Logo work, however, occurs at another time. Occasionally, the teacher will direct something to the entire class, including the student working at the computer: "Kevin, I need to interrupt you so you can hear an announcement for the whole class. . ."

Several times throughout the day students are seen leaving the computer, going to another student in the class, interacting, and then returning to the computer. Sometimes both students will go to the computer for a short time. Then the student who was doing seat work will return to his or her seat and continue working. Listening to these interactions, one hears, "I can't remember how to make the cursor go down"; "How do you make the turtle appear randomly at different places on the screen?"; "SETXY isn't working right"; and "How do you erase a line you don't want?" The explanation for this is that each week two students volunteer to be LOGO EXPERTS. Any student experiencing difficulty while working at the computer has

permission to seek the help of one of these experts. There is one boy and one girl, and it should be noted that the experts are not always the most academically advanced students. The teacher is sharing authority and at the same time greatly reducing the number of interruptions that would otherwise occur.

About 20 minutes before lunch recess, the teacher ends a language arts lesson and walks over to the computer. The schedule says "Whole Class." A few students sitting in the back move forward in order to see better. After asking for volunteers to demonstrate some of their work, two students show a procedure that draws a submarine in water. An airplane is then drawn in the sky. A bomb appears beneath the plane and slowly falls toward the sub, causing an explosion when it hits. This demonstration is followed by a student who demonstrates a procedure that draws Garfield the Cat at random places on the screen. Whenever a student demonstrates a procedure, a discussion follows, shaped by a questioning strategy composed of four questions:

1. **Do any class members have questions about the procedure we've watched?** Several students usually want to know how it is done, so the demonstrators show the inner workings of their procedures. Occasionally, a value-related question arises when a student refuses to show how a procedure works. "I don't want to show it—it's a secret." This leads to a brief discussion about who owns knowledge, and about copyrights and patents. (Usually this motivates one or two other students to discover the secret, which is later gleefully published!)

The second and third questions are addressed to the student who demonstrated the program:

2. **What do you plan to do with your procedure now?** Sometimes the answer is, "Nothing—I'm done with it." At other times, elaborate plans are given. Frequently, the student will respond in a sketchy, tentative manner, as in these examples: "We'd like to have it so that a person can aim and fire the bomb"; "I'd

like to have some music go with the drawing"; or "I'm going to try to figure out how to make each cat a different color." The tentative nature of these responses tells the teacher that the student has encountered a new problem to be solved but does not yet know the solution. Such responses are always followed up by another question:

3. Do you have some ideas to try out or do you need some hints about how to do it? The teacher is seen making notes for students wanting help. The notes read like this:

Ben—give him music routine.

Sarah—have Ann show SETXY and RANDOM

Thane—hint about multiple colors

Keri—tape and walk rainbow starting from center

Raol—no help needed

Several things about this environment are becoming evident. Students decide for themselves whether they need help solving a problem and in so doing they learn to reflect upon and be responsible for their own learning. Some students who want help are given the complete answer to their problem, sometimes by the teacher and sometimes by another student—authority is distributed. Students often are given hints but not complete answers; when guided discovery is used, students frequently experience the joy of finding the solution by themselves. The final question raised after each demonstration leads to a short brainstorming session by the class:

4. What are some things that could be done to change this program? Many fascinating Logo projects result from ideas contributed from several class members. The teacher also contributes ideas—although usually after ideas have emerged from students. The whole class responds to work demonstrated by class members two other times during the week. And on one

other occasion, the teacher demonstrates a new Logo programming idea to the entire class. (Earlier in the year, when Logo was first being introduced, teacher demonstrations outnumbered student demonstrations. Now the balance has shifted.) Throughout the day the teacher is seen consulting a list with eight student names. When a few minutes are available, the teacher looks at the list and selects one student for an five-minute impromptu conference. Tomorrow another eight names will be added to the list.

The first question in these conferences always seems to be, "What are you doing with Logo this week?" Some students have elaborate plans for games or procedures. Other students, exhibiting a very different manner of working, explain that they are "messing around" with one procedure. By "messing around," they apparently mean to work with one procedure, make a change in it, run it, make another change, run it again, etc. Evidently, the teacher does not try to coerce students into adopting another method. "Messing around" with Logo procedures is valued. The teacher is sensitive to and accepting of different intellectual styles.

The second set of questions is usually, "Have you had any unexpected results? Do you have a theory about what caused this? What did you try in attempting to solve the problem?" The teacher uses questions to help students focus upon their own theorizing, and promotes learning by having students theorize, test, and revise instead of always having them learn by direct instruction. The central question in these short conferences always seems to be, "Is there anything you are having trouble with on your current Logo project?" If the answer is yes, the student is asked to draw what happens and if he or she has any ideas about what might be causing the problem. Frequently, the problem is complex enough that the student and teacher agree that they need to watch what happens on the computer. Somehow, a few minutes at recess, lunch, or after school are found so that the problem can be demonstrated.

Sometimes the teacher provides the student with an answer. At other times, the teacher will give hints and encourage the student to try another approach to solving the problem. Often the teacher will tell the student to use the "masking tape strategy." Using this strategy, a problematic design is examined and then taped on the floor. The student plays turtle and walks through the procedure. Using Logo language, the student describes everything he or she is doing to walk the design. Sometimes the teacher or another student copies down each statement. The result is usually the Logo procedure needed to create the design in question. Sometimes students will say that they are done with a project or are bored with it. With some students, the teacher's resources for project ideas are offered as possibilities: *Logo for* the *Apple II* by Abelson, and *Final Report: Brookline Logo Project, Parts II and III,* by the MIT Logo Group.

With other students, the teacher encourages and occasionally directs that something specific be done—usually a project that the teacher believes will open up new Logo vistas for that particular student, as in the following examples: "Bill, I'd like you to do a little project that makes the computer draw umbrellas of increasing size all over the screen. Do you have an idea about how you would do that?" (Bill understands how to use variables and recursion but has not used the two ideas together; the teacher makes sure that Bill has some idea about how to begin so he will not experience great frustration.) "Katie, would you rewrite this procedure that always draws nine-pointed stars the same size? Make it so that you can input both how big and what color the nine-pointed star is. Do you have some ideas about where you would change this procedure?" "Matthew, I think that you will be able to solve your problem if you try the project on the wall that asks you to use a circle to make a slinky design. If you do that project and still can't figure out how to do what you want in your current project, come on back and see me."

After watching and listening to these five-minute interactions throughout the course of a week, several conclusions can be drawn. The teacher

- is sensitive to whether or not students are headed for frustration.
- has in mind a sequence of Logo programming concepts and a large repertoire of Logo project ideas.
- often considers his or her teaching role not as a repository of answers but as a midwife helping students *discover* answers by theorizing about problems and unexpected results.

Using all of this knowledge, the teacher exercises the art of teaching in quickly discerning how to respond to each student as an individual. Some need an answer and some just a hint; some need a practice project; and many need nothing but more computer time. A Logo environment has many of the attributes of a democratic classroom. Authority is distributed; sharing and cooperation are promoted; students look to their classmates as legitimate sources of information; because students make project choices, variety rather than uniformity is the norm; rewards are intrinsic; and differences in working style are valued. There is a sense of shared learning—students may hear their teacher respond, "I'm not sure how to make the computer do that. I'll work on it at home tonight."

What Features Are Conspicuously Absent From a Logo Environment?

There is no evaluation of student learning prepared by the teacher and given to students or parents. There are very few required projects. Many of those that are required are selected specifically for an individual student rather than for the whole class. While there is no formal evaluation of a child's Logo learning, parents are kept abreast of what their kids do, sometimes through a parent night, where students demonstrate their programs. Logo lends itself to class projects, booklets, and calendars with Logo graphic designs by each class member. It should also be noted that Logo

excites students enough to go home and volunteer information to parents on "what we did in school today."

Why Should Such an Environment Be Set Up in a Classroom?

Why should classroom instructional time be used by students in an activity that is not formally evaluated? The most complete answer to these questions is to be found in Seymour Papert's book, *Mindstorms: Children, Computers, and Powerful Ideas.* Logo was created because of a fundamental belief that children can learn many important things without formal instruction. Just as children learn verbal language without formal instruction—a vocabulary of thousands of words and a set of complex syntactical rules for putting words together meaningfully—so too the language of mathematics can be learned. No matter what one's theory about how language is learned, it is a fact that children learn language when they respond to, and are responded to in, a language-rich environment. A Logo environment is a mathematics-rich environment, a context including not only a computer and walls and floors with project ideas but also a place where students and the teacher interact with each other in the classroom. In an environment where mathematical objects and ideas are joyfully shared, played with, discussed, and encouraged, mathematical intuitions and language will be learned without excessive formal instruction. What lies behind all of this is a Piagetian view of children who learn because they naturally make and revise theories about things they are interested in.

How Does One Begin Creating a Logo Environment?

Once you begin learning Logo yourself, introduce it in your classroom. This article was written with self-contained classroom teachers in mind. In middle schools, high schools, and other situations that are not self-contained, teachers can invent other ways of organizing. Get Logo going as a peripheral activity; that is, let your regular curriculum proceed but allow individual students to miss parts of it. Students who miss instruction can be treated like students who are absent. With older students, it is possible to strike a bargain—a classroom group agreement. A student working

on the computer will be responsible for checking with a friend about what he or she has missed.

In the beginning you will need to demonstrate a number of things to the whole class. The question of scope and sequence is problematic. Logo inventors fear that if a scope and sequence is published it will invite the belief that students should be accountable for learning Logo programming concepts. This will inevitably lead to evaluation of student learning. This will lead to Logo being a joyless, unnatural learning activity. Logo was not meant to be taught, and the kind of learning that occurs was not meant to be evaluated like other school learning!

With the above warning, I present a sequence I used recently:

- Moving the turtle around the screen and using the REPEAT command
- Saving pictures on disks
- Creating procedures—TO command
- Saving procedures on disks
- Editing procedures—moving cursor around in the editor
- Developing problem-solving strategies—tape it, walk it, turtle talk it
- Placing designs on screen—RANDOM and SETXY primitives
- Using variables
- Doing and printing arithmetic
- Using procedures in other procedures
- Analyzing designs—looking for repeated patterns
- Using simple recursion (tail recursion)
- Taming recursion—TEST, IFTRUE, IFFALSE, IF-THEN STOP primitive
- Using recursion with variables

- Analyzing designs—repeated but slightly changing patterns
- Using Dynaturtle
- Making a "hot" keyboard (individual keys make things happen)
- Working with music procedures
- Printing numbers, words, and lists—WORD, SENTENCE primitives
- Using superprocedures and subprocedures
- Planning a game
- Knowing list-processing commands—FIRST, BUTFIRST, LAST, BUTLAST primitives

This sequence is very flexible. For example, printing numbers, words, and lists, and writing music could be taught to students in the first few days.

After you have students starting to create designs, begin the "Whole Class" demonstrations where students show their work. Try the questioning strategy mentioned in the article. As you begin responding to students who say, "I can't," try to get them to theorize about what causes the unexpected to occur. Show them how to use the TRACE command. Make them use tape and walk the design they are aiming for. Try seeing yourself as a facilitator and not as an answer machine.

Don't let the work involved in looking into the readings suggested below prevent you from starting. It is in the spirit of Logo that you should begin the project of creating a Logo environment with the idea that you will try something, debug it, and try again.

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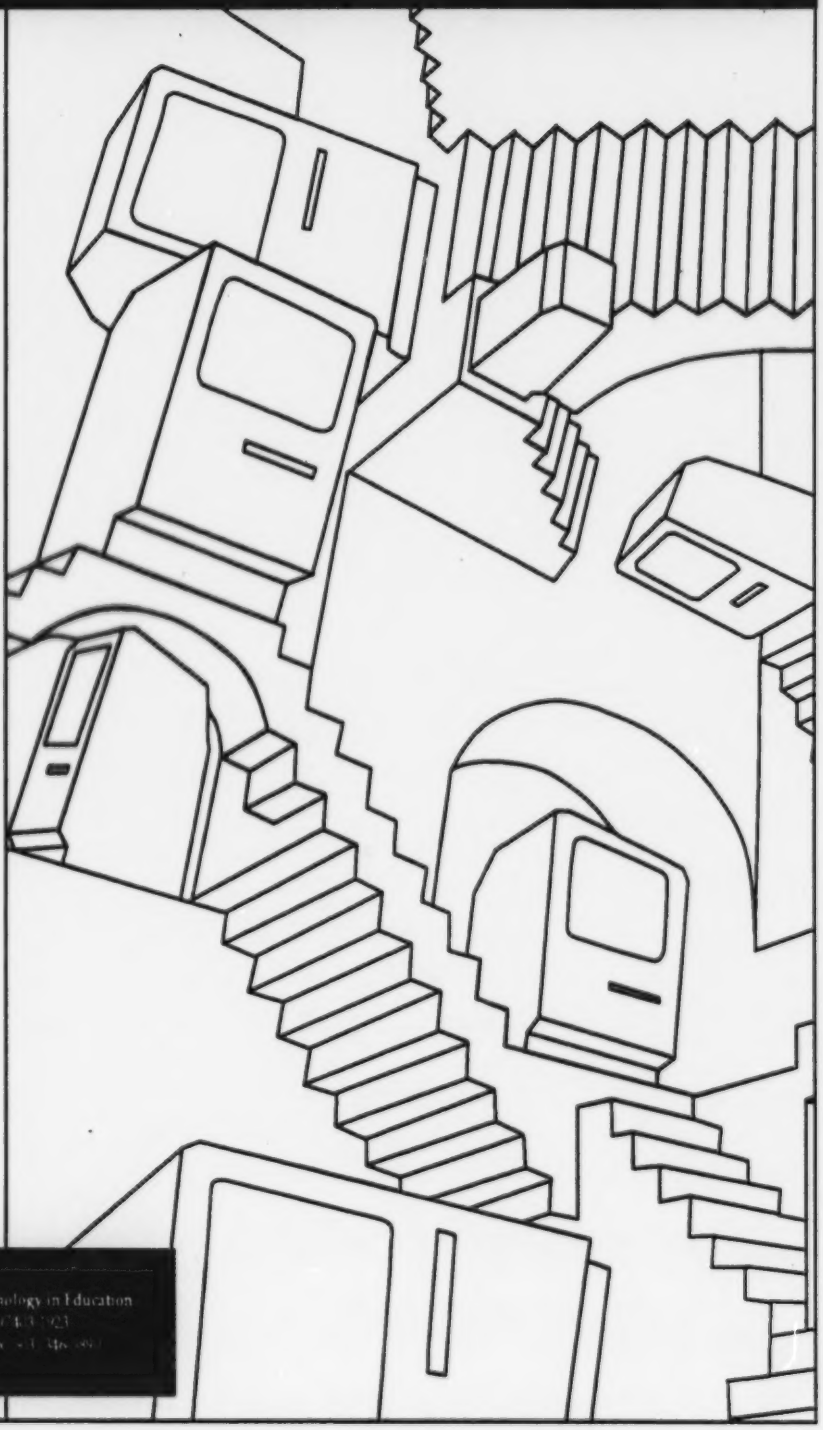

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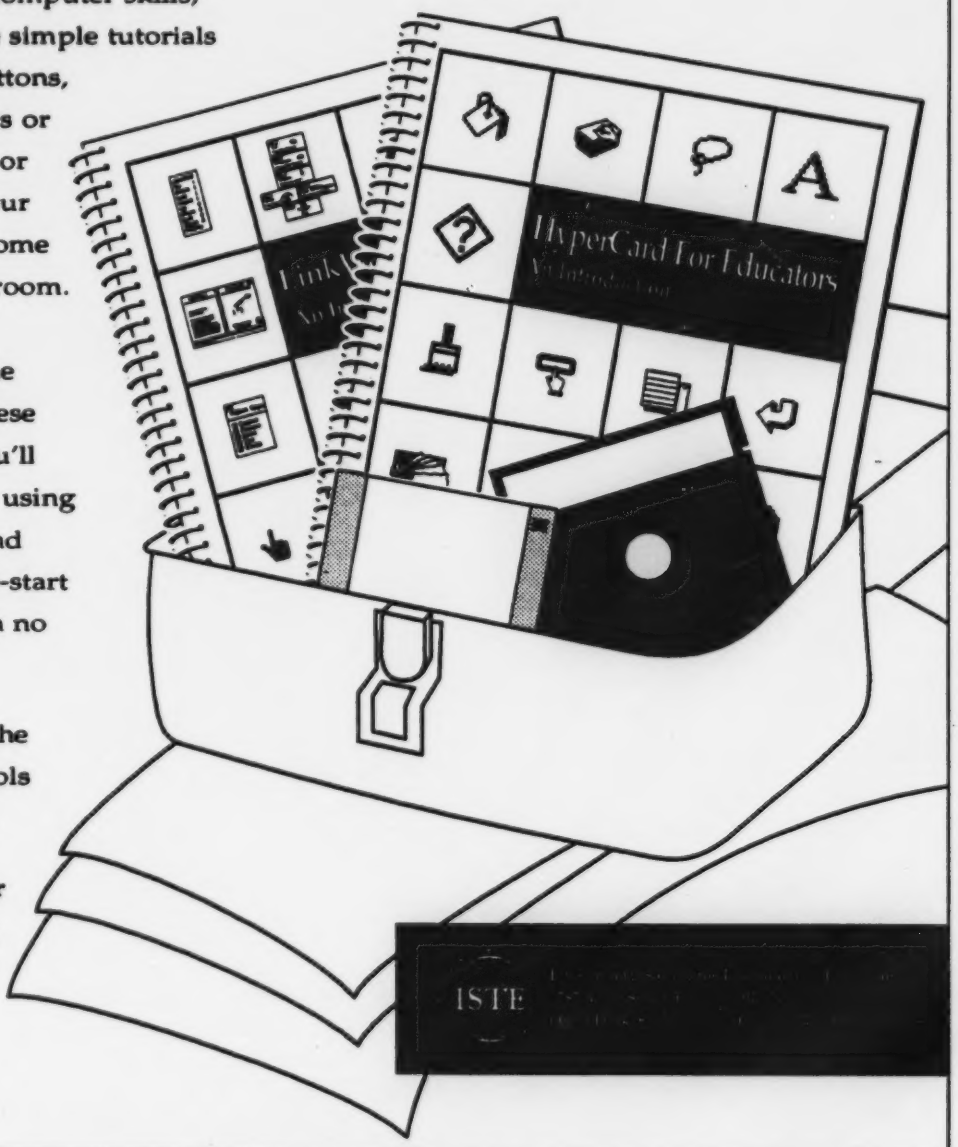

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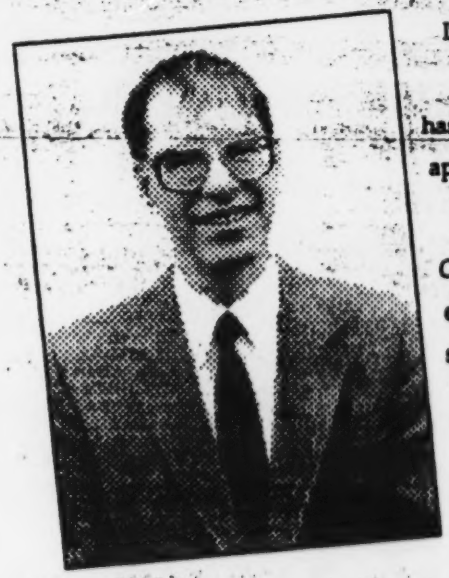

ISTE Executive Officer Dave Moursund is dedicated to improving education.

Since he first began working with computers in education in 1963, Dave has constantly sought to improve education at all levels through the use of appropriate computer-related technology.

As a continuing part of this effort, Dave's newest book—*The Technology Coordinator*—discusses the goals of education and how teachers and teachers of teachers can join in the enormous change process facing today's schools.

This book was written for educators who want to play a leadership role in the instructional use of technology. Dave uses interviews with technology coordinators to illustrate the needs, roles, and qualifications needed to accomplish the goals of educational technology.

In recent years, Dave has focused much of his writing efforts on problem solving and on staff development. Some of Dave's other books also available from ISTE include *Problem-Solving Models for Computer Literacy, LogoWriter for Educators: A Problem Solving Approach, Logo PLUS for Educators: A Problem Solving Approach* (co-authored with Sharon Yoder), and *Effective Inservice for Integrating Computer-as-Tool into the Curriculum.*

"Our educational system is not nearly as good as it could be," says Dave. "We know that computer-related technology can make substantial contributions to improving both the content of the curriculum and the instructional delivery system. Such technology can empower students and teachers."

ISTE believes that computer-related technology must become a tool that students and teachers use routinely if students are to be adequately prepared for adult citizenship in our Information Age society.

ISTE's wide range of periodicals, publications, projects, and other activities mirror this vision and commitment.

Call us today to order Dave's latest books, and discover how he and ISTE are leading the way for the educators and school systems of tomorrow.

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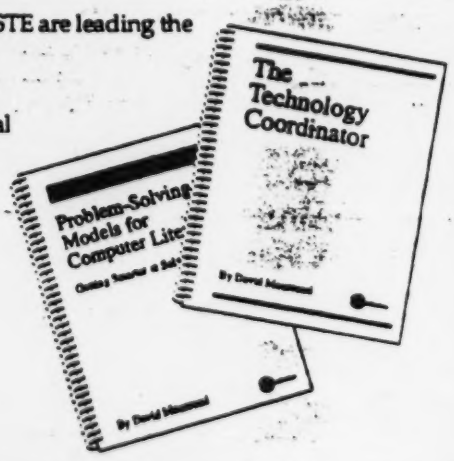

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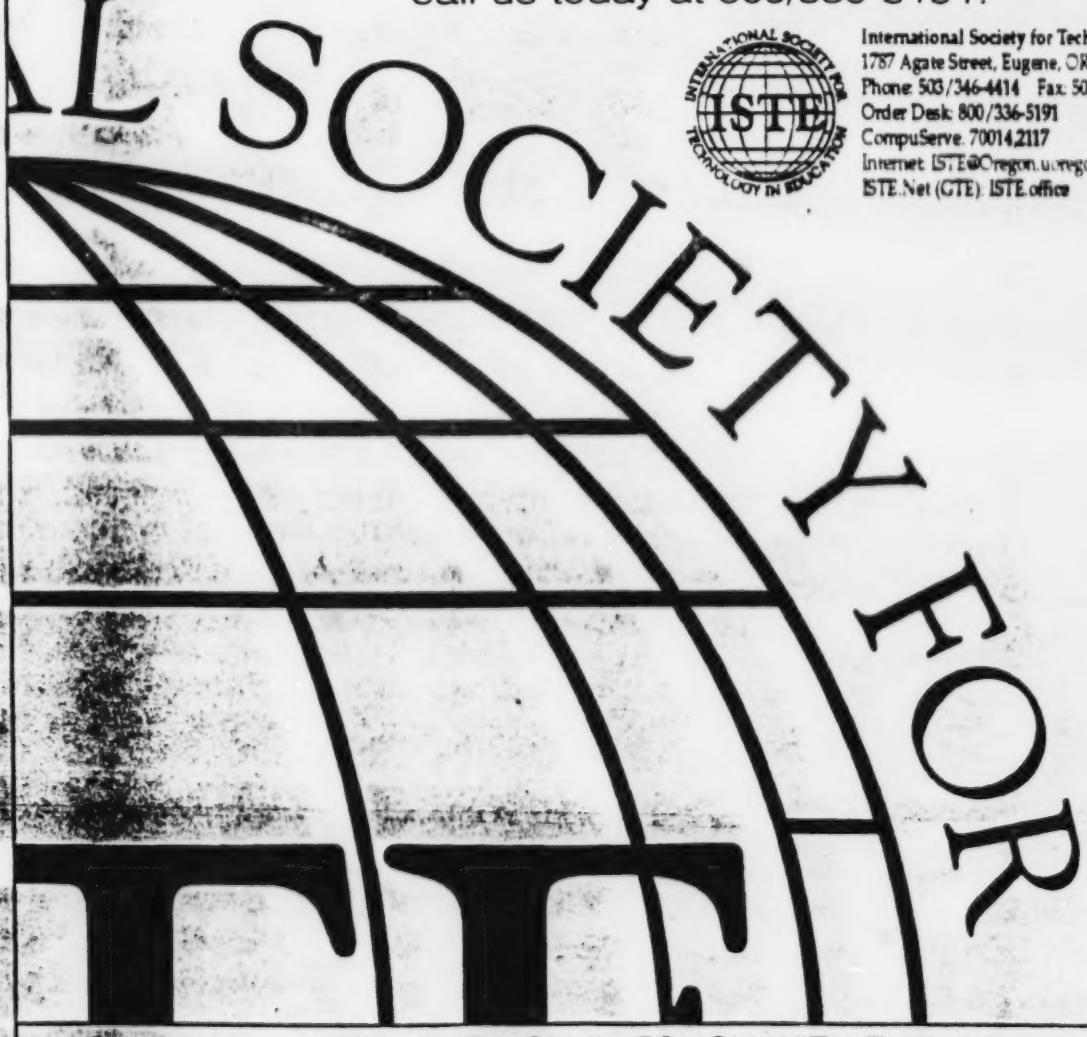

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